

Amateur **RADIO**

For all two-way radio enthusiasts

**A Basic System:
Starting
on 10GHz**

**Construction:
One Chip
Burglar Alarm**

**A User Review:
The Racal RA 117E
HF Communications Receiver**



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ICOM IC-R7000



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ICOM IC-3210



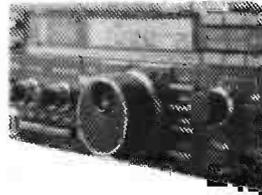
ICOM's popular dual bander, 25 watts on both bands, great looking and readable display, full duplex capability, 40 memories and input monitor for instant repeater check. All you need add is an antenna and we have taken care of that.

Regular retail prices:
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ICOM IC-725



ICOM's latest addition to the family, the 725 gives a full 100 watts of multi-mode power and is the second rig to use the DDS (Direct Digital Synthesizer) system. 10 Hz steps for smooth tuning, all mode squelch, 26 memories, and many other features make the 725 the starter rig for those who want more than a starter rig - it's unbeatable value - just look!

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YAESU FT-470



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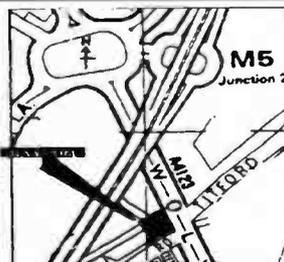
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Amateur RADIO

**Editorial:**

Iain Mackenzie

Advertisement**Manager:**

Maria Smith

Subscriptions:

01-684 9542

Publisher:

Peter Williams

On sale:

Last Thursday of
the month preceding
cover date

Next Issue:

Cover date February on
sale 25 January 1990

Published by:

Amateur Radio
Magazines,
Sovereign House,
Brentwood, Essex.
CM14 4SE, England
(0277) 219876

Printed: In England

ISSN: 0264-2557

News Trade Sales by:

S M Distribution,
6 Leigham Court Road,
Streatham, London.
SW16 2PG
Tel: 01-677 8111

Cover: The Kenwood TH-
25E 2m and TH-45E 70cm
FM hand-held transceivers

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AF118 3.50	BC161 0.55	BC338 0.09	BD233 0.33	BF183 0.29	BF499 0.23	BT208B 1.35	OC44 1.25	TIP29C 0.42	2N3792 1.35	2SC2028 1.15
AF121 0.60	BC170B 0.15	BC347A 0.13	BD236 0.49	BF184 0.35	BF499 0.23	BT208C 1.20	OC45 1.00	TIP30C 0.42	2N4280 3.50	2SC2029 1.95
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AF125 0.65	BC172B 0.10	BC478 0.20	BD242 0.65	BF195 0.11	BF499 0.23	BT208E 1.20	OC71 0.75	TIP32C 0.42	2N4474 1.15	2SC2091 0.85
AF126 0.45	BC173B 0.10	BC527 0.20	BD246 0.75	BF197 0.11	BF499 0.23	BT208F 1.50	OC72 1.50	TIP33C 0.95	2N5294 0.42	2SC2098 2.95
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AF139 0.40	BC177 0.15	BC548 0.10	BD379 0.45	BF199 0.14	BF499 0.23	BT208H 1.00	OC81 1.00	TIP41A 0.45	2N5298 0.60	2SC2314 0.80
AF150 0.60	BC178 0.15	BC549A 0.10	BD410 0.65	BF240 0.20	BF499 0.23	BT208I 1.15	OC84 1.50	TIP41C 0.45	2N5496 0.95	2SC2371 0.36
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2.95 4C 1.95 4C35 145.00 4C250R 285.00 4CX125C 9.50 Elmac 150.00 4CX250B 45.00 4CX250B 45.00 4CX250B 68.00 4CX250K 9.50 EIMAC 115.00 4CX250R 9.50 4CX250R 9.50 4CX350A 100.00 4CX1000A 100.00 4CX1500B 475.00 4CX5000A 1000.00 4D21/4-125A* 85.00 4D32 125.00 4E27A 125.00 4G57 2.25 4G7V 2.25 4J06A 2.95 4K76 1.50 4T85P 150.00 4X150A 35.00 4X150D 55.00 4X500A 350.00 5A/102D 9.50 5A152M 9.00 5A163K 10.00 5A170K 6.25 5A-180M 9.00 5B-208K 10.00 5B-110M 10.00 5B-254M 11.80 5B-255M 11.50 5B-256M 15.00 5B-257M 15.00 5B-258M 14.90 5C22 125.00 5CL8A 2.50 5J180E 1950.00 5LJ8 2.95 5R46G 8.50 5R4GY 4.95 5R4WGY 5.95 5T4 5.95 5T8A 1.95 5U4G 4.50 5U4GB 4.50 5U4G 2.50 5W4 4.95 5X4 4.95 5Y3GT 3.50 5Z3 4.80 5Z4G 2.50 6/30L2 0.70 6A203K 9.00 6A7 4.95 6A8 2.50 6AB7 4.50 6AC7WA 2.00 6AG5 2.50 6AG7 2.50 6AH6 3.50 6AJA 3.50 6AJ7 2.00 6AK5 1.95 6AK6 2.50 6AL5 0.85 6AM4 3.25 6AM5 4.50 6AM6 1.95 6AN5 4.50 6AN8A 4.50 6AQ5 1.75 6AQ8 1.50 6AR5 8.95 6AS5 1.50 6AS6 2.50 6AS7G 4.50 6AT6 1.95 6AT8 1.75 6AU4GT 2.95 6AUGT 4.50 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2.50 6HB7 1.95 6HF8 3.50 6HM5 2.50 6HQ5 3.50 6HS6 4.95 6HS8 2.95 6HZ6 3.50 6J4 2.15 6J5GT 2.50 6J6 2.00 6J7 4.15 6J7G 4.15 6JB6A 0.90 6JE6C 0.50 6JM6 0.50 6JUBA 2.50 6JS6C 0.50 6K7G 2.00 6K8G 3.00 6KD6 10.50 6KG6A 6.95 6L1 2.50 6L6GC 3.50 6L6GC USA 0.50 6L6GT 3.50 6L7 3.50 6L15 3.15 6L19 3.95 6LJ8 2.50 6LD20 1.15 6LF6 11.50 6LQ6 9.50 6P28 2.00 6Q7GT 1.50 6R7 3.18 6RRH8 10.00 6S4A 1.95 6SA7 1.95 6SC7 1.95 6SH7 1.95 6SJ7GT 1.95		6SK7 1.95 6SL7GT 1.95 6SN7GT 1.95 6SQ7GT 1.95 6S57 1.95 6T8 1.50 6UG6T 3.50 6U7G 3.50 6U8A 1.50 6V6G 1.45 6V6GT 2.50 6WAGT 1.95 6Y6G 3.95 6X2N 1.00 6X4 1.50 6X5GT 1.00 6X8A 2.25 6A 4.50 6A7 1.50 6B6 3.50 6B7 2.50 6D8 4.50 6J7 5.50 6K7 7.50 6L 1.50 6Q7 4.50 6Y4 2.50 6B8 2.50 6B10 2.50 6BQ5 1.95 6CW5 1.50 6E8B 1.95 6FQ7 1.95 6G2 1.25 6I0D7 2.50 6I0DX8 2.50 6I0EB8 1.95 6I0E7 2.95 6I0F1 1.95 6I0GK6 1.95 6I0P14 2.50 6I1E3 55.00 6I1R3 5.80 6I2A6 3.95 6I2AD6 2.50 6I2AE6 5.50 6I2AH7GT 4.50 6I2AL5 1.95 6I2AT6 1.75 6I2AT7 1.50 6I2AT7WA 2.50 6I2AU6 2.50 6I2AU7 0.85 6I2AV6 1.95 6I2AV7 2.50 6I2AXAGTB 2.50 6I2AX7 0.95 6I2AX7WA 2.50 6I2AX7S 7.95 6I2AY7 3.95 6I2BA4 4.50 6I2BA6 1.95 6I2BE6 2.50 6I2BH7A 4.95 6I2BL6 1.50 6I2BR3 1.95 6I2BY7A 2.50 6I2C8 2.50 6I2CA5 1.95 6I2CX6 1.95 6I2D06B 3.50 6I2DWA4 3.50 6I2DZ6 3.95 6I2E1 19.50 6I2E14 38.00 6I2E15 1.95 6I2G7 5.90 6I2J7G 3.50 6I2JZ8 2.95 6I2K7GT 1.95 6I2K8Y 1.95 6I2KU7 1.95 6I2S7GT 1.50 6I2S7GT 1.95 6I2SK7 1.95 6I2SJ7 1.95 6I2SN7GT 1.95 6I2SW7 3.50 6I2SX7 4.50 6I2X4 1.95 6I2Y7 3.20 6I3D7 2.50 6I3DR7 2.95 6I3EM7 1.50 6I3EM7 3.50 6I3F7 3.50 6I3G3 1.95 6I3G5 2.95 6I3H 0.40 6I3L 0.40 6I3A3 3.50 6I3B3 1.95 6I3C3 2.50 6I3D3 2.50 6I3E3 2.50 6I3F3 2.50 6I3G3 2.50 6I3H3 2.50 6I3I3 2.50 6I3J3 2.50 6I3K3 2.50 6I3L3 2.50 6I3M3 2.50 6I3N3 2.50 6I3O3 2.50 6I3P3 2.50 6I3Q3 2.50 6I3R3 2.50 6I3S3 2.50 6I3T3 2.50 6I3U3 2.50 6I3V3 2.50 6I3W3 2.50 6I3X3 2.50 6I3Y3 2.50 6I3Z3 2.50		20L1 0.95 20P1 0.55 20P4 1.95 20P5 1.15 20J26 6.50 21K06 4.95 21L08 3.75 24B1 39.50 24B9 39.50 25BQ6 1.95 25DQ6B 2.75 25L6GT 1.75 29C1 19.80 29KQ6 6.50 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LEVEL

ON THE COVER

On the front cover this month are, from left to right: the Kenwood TH-25E 2m and TH-45E 70cm FM hand-held transceivers.

Key features include a large, easy-to-read LCD; wide range power supply; tone alert system, fourteen-channel memories with lithium battery back up; built-in automatic battery saving circuit; rotary encoder selector; auto power-off and scan functions; and many others.

Both rigs are powered by a 5W RF output power supply. Also available is a wide selection of optional extras.

The TH-25E costs £238.00. The TH-45E costs £269.00. Both prices include VAT.

For further information contact *Lowe Electronics Ltd, Chesterfield Road, Matlock, Derbyshire DE4 5LE. Tel: (0629) 580800.*

LOW COST IAMBIC KEYS

The PEK-1 electronic keyer from ProElectron is the first in a range of professionally designed and tested PCB modules for the radio amateur.

Assembled on a high-quality CAD designed PCB, measuring only 74 x 61mm, the keyer can be built into existing equipment or, with the addition of a case and connectors, form a stand-alone unit.

The PEK-1 electronic keyer can be used with single or twin paddles, offering features which include dot and dash memories; built-in speed control; sidetone output; and low power consumption. Both solid-state VMOS and relay outputs enable a wide range of transmitter keying options. The PEK-1 costs £22.00 including VAT.

For further information contact *ProElectron, 35 Cromwell Road, Cheltenham GL52 5DN. Tel: (0242) 571223.*

ELECTRIC CIRCUIT TESTER

Longs Ltd have announced a new range of electrical

circuit testers, the ME3060 and ME3020. These digital voltmeters, made by SOAR, are revolutionary because of their compact size and ease of use.

Top of the range is the high speed ME3060 which has a bargraph display for fast, accurate readings. It has a battery life of over 250 hours and an automatic shut-off safety function.

Like the ME3060, the ME3020 is fully protected up to 450V rms.

The ME3060 costs £35.08. The ME3020 costs £23.58. Both prices include VAT and postage.

For further information contact *Longs Ltd, Hanworth Lane, Chertsey, Surrey KT16 9LZ. Tel: (0932) 561241.*

NEW C19 PLUGS AND SOCKETS

Watts International have introduced their new range of Feller C19 high voltage plugs and sockets. They are rated at 16A, 240V and are ideal for high power applications, especially with equipment using three-phase power.

For further information contact *Watts International Ltd, No 4 Phillips Business Centre, Terminus Road, Chichester, West Sussex PO19 2UL. Tel: (0243) 533479.*

THE BRISK TEN

New to Electronic and Computer Workshop Ltd is the Brisk Ten, a hand-held digital multimeter with automatic and manual range selection, including facilities for diode and continuity testing.

This multimeter incorporates the standard 3½ digit LCD to a maximum reading of 1999 and features autopolarity, over-range and battery warning indication. Its accuracy is to ± 0.5% reading, ± 4 digits dc.

It will measure in the following ranges: volt dc, 200mV-2V-20V-200V-1000V; volt ac, 2V-20V-200V-750V; amp dc-ac, 200mA-10A; resistance, 200 ohms - 2k ohms - 20k ohms -

200k ohms - 2M ohms - 20M ohms.

The Brisk Ten has a battery life of 300 hours continuous operation, and measures 100x85x29mm and weighs 250g. It is supplied with a pair of test leads, spare fuse and instruction manual. The multimeter costs £69.00 including VAT.

For further information contact *Electronic and Computer Workshop Ltd, Unit 1, Cromwell Centre, Stepfield, Witham, Essex CM8 3TH. Tel: (0376) 517413.*

JAMMING

BBC World Service broadcasts in Mandarin to China are being jammed by the Beijing authorities since June 1989, the BBC have confirmed. This comes at a time when jamming from all other Communist countries has ceased.

Interference with BBC Mandarin broadcasts takes the form of steady low frequency noise about 25% as strong as the programme itself. The interference starts a few minutes before transmissions begin and stops shortly after they end.

CLUB NEWS

The Torbay Amateur Radio Society meets every Friday at 7.30pm at the ECC social club, Hlweek, Newton Abbot.

The society's programme of events for January includes club nights on the 5th, 12th and 26th. On 19 January there will be a construction competition.

For more information contact *the club secretary Walt G3HTX, tel: (0803) 526762.*

The South East Kent (YMCA) Amateur Radio Club meets every Wednesday at the YMCA, Leyburne Road, Dover, for an 8.00pm start.

On 10 January G4HXE will be giving a talk on TVI - the Problems and Cure. On the 17th there will be a Natter Night and committee meeting. On the 24th G42MQ will

All the latest news, views, comment and developments on the amateur radio scene

be giving a talk about the Early Days of Television. A Natter Night will be held on the evening of the 31st.

For further information contact the club secretary Brian Joyner G3ZYZ, tel: (0304) 852533.

The Wimbledon and District Amateur Radio Society meets on the second and last Friday of each month at 7.30pm at the St Andrews Church Hall, Herbert Road, London SW19.

The programme of events for January includes a Night on the Air on the 26th.

For further information contact the club secretary Steve Cook G8CYY, tel: 01-541 1682.

The Pembrokeshire Radio Society meets every Monday at 7.30pm at the Further

Education Centre, Haverfordwest, Pembrokeshire, Dyfed. The club would like to hear from anyone in the area who has an interest in amateur radio.

The club organises lectures, informal talks, demonstrations, RAE classes and Morse practice exams. It also arranges visits to rallies etc.

For further information contact Martin GW8ZMU QTHR, tel: (0439) 764009.

The Taunton and District Amateur Radio Society has announced the following newly appointed officers.

They are: E A Hayden G4LZU, chairman; W A Lindsay-Smith G3WNI, club secretary; and J Collier G1AKZ, who is the club treasurer.

The club meets on the first

and third Friday of each month at 7.30pm at the Basement, County Hall, Taunton.

For further information contact the club secretary W A Lindsay-Smith G3WNI, tel: (0823) 680778.

The Mansfield Amateur Radio Society meets on the first and third Thursday of every month at 7.30pm at its new venue: the Polish Catholic Club, Windmill Lane, off Woodhouse Road, Mansfield.

For further information contact the club chairman J M Coates G4GYU, tel: (0623) 27257.

The Denby Dale (Pie Hall) and District Amateur Radio Society has recently announced its new correspondence address, which is as follows: J D

Chappell G0BWB, 221 Huddersfield Road, Shelley, Huddersfield HD8 8LJ.

For further information contact the club secretary, Darran Chappell, at the above address.

The Verulam Amateur Radio Club meets on the second and fourth Tuesday every month at 7.30pm at the RAF Association Headquarters, New Kent Road, St Albans, Herts.

On 9 January there will be an Activity Evening. On the 23rd at 8.00pm G0BZS will be giving a talk entitled Avionics, from dc to Light.

For further information contact the honorary secretary Andy Ince, Cottage No 1, Rounton, 28 Nascot Wood Road, Watford WD1 3SD. Tel: (09277) 62180.

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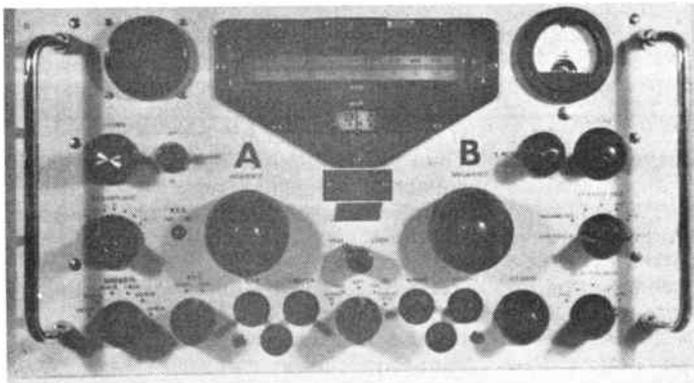
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A USER REVIEW



THE RACAL RA 117E HF COMMUNICATIONS RECEIVER

The RA 117E HF Communications Receiver is the second 'classic' receiver I have reviewed and, believe me, it is some receiver. Nostalgia is in fashion these days so bearing that in mind, this rig – which was arguably the Rolls-Royce of receivers in its day – might be of interest to readers.

As you will see from the specification shown in the Table, the RA 117E has nearly everything you could want, even though the rig is nearly thirty years old. Its design offers high selectivity and stability, and the rig was manufactured by Racal Electronics Ltd in the early 1960s.

Physically it is as solid as a rock, weighing some 62lb. The chassis and major modules are of cast construction, which ensures maximum rigidity and excellent electrical screening. The receiver is suitable for both bench and rack mounting; and the dimensions of the 1/2in thick front panel conform to the requirements for mounting in a standard 19in rack.

Description

The circuitry of the RA 117E works in the following manner. The set has an input impedance of 75 ohms for all positions of the AERIAL RANGE switch, except WIDEBAND, where the input impedance is 2000 ohms.

The antenna is tuned by a capacitor marked AE TUNE on the right-hand side of the front panel. This capacitor is switched out of circuit in both WIDEBAND positions. The antenna circuitry also features a five-position attenuator, covering a range of 0 to 40dB. The set, therefore, can be connected to most types of antenna and still have an excellent match.

Input signals of between 0.98 and 30MHz are fed via the RF amplifier and a 30MHz lowpass filter to the first mixer (see M1 on the block diagram shown in Fig 1) where they are mixed with the output from the first Variable Frequency Oscillator VFO-1 (labelled MEGAHERTZ, knob B). This oscillator has a frequency range of 41.5 to 69.5MHz.

The first IF stage is, in effect, a bandpass filter tuned to 40MHz \pm 650kHz. Therefore, according to the setting of

VFO-1, any spectrum of signals 1MHz wide which exists in the 0.98 to 30MHz range can be mixed in M1 to give an output which is acceptable to the first IF bandpass filter.

The next feature is that of the harmonic generator and the first mixer. The output from a 1MHz crystal oscillator is connected to the harmonic generator and passed through a 32MHz lowpass filter,

Specifications of the RA 117E

Frequency range	1-30MHz														
Stability	After warm-up, overall drift is less than 50Hz/hour under conditions of constant supply voltage and ambient temperature														
Input impedance	1. Wideband 2000 ohms approximately 2. Wideband 75 ohms 3. Five double-tuned circuits, 75 ohms (a) 1-2MHz (c) 4-8MHz (e) 16-30MHz (b) 2-4MHz (d) 8-16MHz														
Tuning	Effective scale length of approximately 145ft, ie, 6in of scale length corresponds to 100kHz. Frequency increments remain constant over the entire range														
Calibration	A 100kHz signal is derived from a 1MHz crystal oscillator having an accuracy of 5.0 parts in 10 ⁶ provides checkpoints at 100kHz intervals														
Sensitivity	A1A reception: bandwidth 3kHz; 1 μ V for 18dB S/N ratio F2A reception: 30% modulated, bandwidth 3kHz; 3 μ V for 18dB S/N ratio														
Intermodulation	More than 100dB down for interfering signals at least 10% removed from wanted signal														
Cross-modulation	For wanted signal levels between 3 μ V and 1mV, an interfering signal 10kHz, removed and modulated 30%, must have a level greater than 50dB above that of the wanted signal to produce a cross-modulation of 3%. The ratio of wanted to unwanted signal is improved up to 10% off tune at the rate of 3dB percent														
Blocking	With similar conditions to those for cross-modulation, an unwanted signal F2 must be 60dB greater before the audio output of the wanted signal F1 is reduced by 3dB due to blocking														
Selectivity	Six alternative IF bandwidths are obtained via a selector switch. Filter details are: <table border="0" style="margin-left: 20px;"> <tr> <td style="text-align: center;">-6dB</td> <td style="text-align: center;">-66dB</td> </tr> <tr> <td>1. 13kHz</td> <td>35kHz</td> </tr> <tr> <td>2. 6.5kHz</td> <td>22kHz</td> </tr> <tr> <td>3. 3.0kHz</td> <td>15kHz</td> </tr> <tr> <td>4. 1.2kHz</td> <td>8kHz</td> </tr> <tr> <td>5. 0.3kHz</td> <td>Less than 2kHz</td> </tr> <tr> <td>6. 0.10kHz</td> <td>Less than 1.5kHz</td> </tr> </table> Bandwidths five and six are obtained with crystal lattice filters; differences in centre frequencies of these bandwidth settings do not exceed 50Hz	-6dB	-66dB	1. 13kHz	35kHz	2. 6.5kHz	22kHz	3. 3.0kHz	15kHz	4. 1.2kHz	8kHz	5. 0.3kHz	Less than 2kHz	6. 0.10kHz	Less than 1.5kHz
-6dB	-66dB														
1. 13kHz	35kHz														
2. 6.5kHz	22kHz														
3. 3.0kHz	15kHz														
4. 1.2kHz	8kHz														
5. 0.3kHz	Less than 2kHz														
6. 0.10kHz	Less than 1.5kHz														
IF output	100kHz at 75 ohms impedance.														

then mixed with the output from VFO-1 in the harmonic mixer. The mixer provides an output at 37.5MHz which is amplified before passing through a bandpass filter tuned to 37.5MHz, having a bandwidth of $\pm 150\text{kHz}$. Because of this filter the setting of VFO-1 is restricted to an exact number of megahertz plus 37.5MHz in order to give an output which is acceptable to both the filter and amplifier. Consequently the first VFO must be tuned in 1MHz steps.

The 40MHz first IF signal is mixed in the second mixer (M2, see Fig 1) with the 37.5MHz output from the harmonic mixer to produce an output consisting of a 1MHz spectrum in the frequency range of 2-3MHz; this being the second IF.

The input to the third mixer is preceded by a pretuned bandpass filter. The output from this filter is mixed in the

third mixer (M3) with either the output from VFO-2 (labelled KILOHERTZ, knob A), or an external signal within the frequency range of 3.6 to 4.6MHz to provide the third IF of 1.6MHz. This 1.6MHz IF is mixed in the fourth mixer (M4) with the 1.7MHz output from the 1.7MHz oscillator/amplifier to provide the fourth and final IF of 100kHz.

The final IF stages are preceded by crystal lattice and LC filters which provide six alternative bandwidths. A separate signal and Automatic Gain Control (AGC) diode are used, and alternative switched time-constants give optimum conditions for either telegraphy or telephony. There is also an additional IF amplifier to give an independent output at 100kHz, if required.

Two independent audio stages are

provided for either line output or 'phones and internal loudspeaker. Each stage is provided with a level control. A crystal calibrator is incorporated to enable the scale of VFO-2 to be checked at 100kHz intervals when the VFO switch is set to INTERNAL. These checkpoints are obtained from a regenerative divider controlled by the 1MHz crystal oscillator.

Audio signal

The audio signal is applied to the control grid of V23B (a 12AT7 or ECC81) via the AF GAIN control. The output transformer provides four separate outputs (1W into 3 ohms) and three windings supply 3mW into 600 ohms.

The noise limiter circuitry does not, in my opinion, compare with the circuits in modern sets, but this is to be expected; it is a series circuit designed to operate at 30% modulation. When noise impulses corresponding to high modulation peaks appear the voltage across the noise limiter diode V21 (a 6AQ5 or EB91) changes from negative to positive, causing the diode to stop conducting and open-circuiting the AF signal path.

The receiver does not have upper or lower sideband as we know them today, but it has a Beat Frequency Oscillator (BFO) which can be adjusted with the panel control to either plus or minus the frequency being received when the BFO is switched into circuit. This means that the operator has to adjust the required pitch of the SSB signal to hear intelligible speech.

To receive lower sideband the BFO has to be on the minus side and upper sideband the positive side. You can check the operation of the BFO by switching the bottom control, labelled SYSTEM SWITCH, to CHECK BFO. The same control switches the AGC IN or OUT and also the calibrate circuit CAL.

The primary of the mains transformer is tapped to provide inputs of 100-125V and 200-250V, and capacitors are provided to remove mains interference. A bridge-connected full-wave rectifier is in circuit to give the high tension voltages necessary.

Operation

I have been accustomed to modern receivers and transceivers, where there is a number of very small controls to work, so it takes time to operate knobs which go 'clunk' and require physical effort to move.

The convenience of having 1MHz of coverage stretched out to 145ft is very helpful. The drift figures are the same as those quoted by Racal, and since the cursor or marker line for the scale is adjustable, it is possible to get an accurate frequency reading which stays put after the warm up period.

An interesting facet of the RA 117E is the combination of the AERIAL TUNE and AERIAL RANGE MHz controls.

IF output	Level 0.2V approximate with automatic gain control in operation. Two outlets in parallel are provided		
Image and spurious responses	With wideband or tuned input, external image signals are at least 60dB down. Internally generated spurious responses are less than 2dB above noise level in all cases		
Noise factor	Better than 7dB		
BFO range	BFO range $\pm 8\text{kHz}$		
BFO stability	With constant ambient temperature and supply voltage, drift after warm-up does not exceed 50Hz. For input level variations from 10 μV to 1mV, BFO drift is negligible		
Automatic gain control	An increase in signal level of 20dB above 1mV improves the S/N ratio by 18dB. An increase in signal level of 100dB above 1mV increases the AF output by less than 7dB		
Automatic gain control time constants	Short:	Charge 25 milliseconds Discharge 200 milliseconds	
	Long:	Charge 200 milliseconds Discharge 1 second	
AF response	With 13kHz bandwidth, response remains within $\pm 4\text{dB}$ from 250Hz to 6000Hz		
AF output	1. 2.5in speaker on front panel.(switched) 2. Two 'phone sockets in parallel on the front panel 3. Three independent outputs of 3mW at 600 ohms at rear of chassis 4. One output of 10mW at 600 ohms. Preset level is independent of AF gain control setting 5. One output of 1W at 3 ohms Note: The two 'phone sockets are connected across one of the 600 ohms, 3mW outlets		
Distortion	Not greater than 5% at 10mW output, 1000Hz Not greater than 10% at 1W output, 1000Hz		
Hum level	With AF gain control at maximum, the hum level should be no worse than 40dB below rated output (1W)		
Noise limiter	A series noise limiter can be switched into operation to provide limiting at modulation levels exceeding 30%		
Meter indication	Alternative switching for indication of signal carrier level. AF output level or 'S' meter indication		
Power supply	100-125V or 200-250V, 45-65Hz. Power consumption is 100W approximately		
Dimensions	Height	Width	Depth
For rack mounting	10.5in (267mm)	19in (482.5mm)	20.125in (510mm)
Fitted cabinet	12in (305mm)	20.5in (520mm)	21.875in (556mm)
Weight			
Rack mounted	62lb (28kg)		
In cabinet	92lb (42kg)		
Environment	Operating temperature range 0°C to +55°C Storage temperature range -20°C to +70°C		

A USER REVIEW

These allowed virtually any type of antenna to be tuned for peak performance.

During the review period, high winds brought down my 80m dipole antenna, so I had to manage with half of it attached to the top edge of a window frame. Nevertheless, there was no difference in the sensitivity on all ranges; 28MHz particularly, was very much alive.

The six filter positions are quite

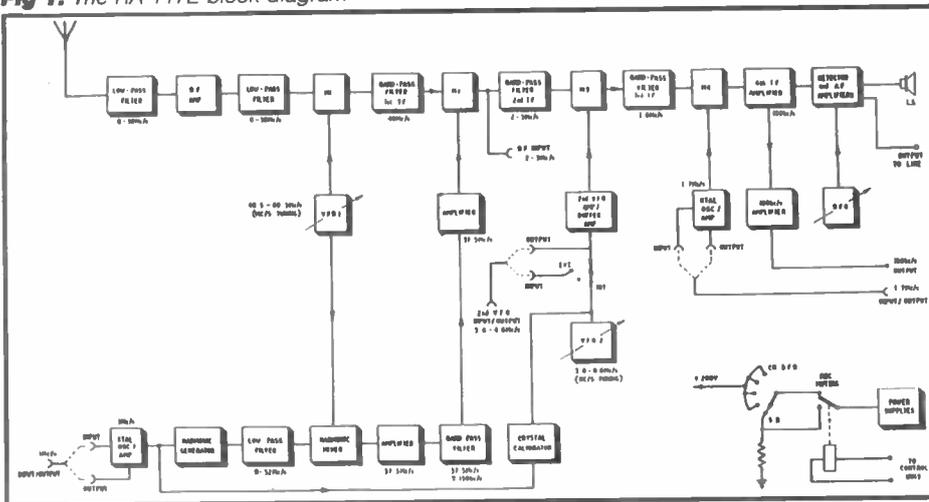
amazing in operation, taking into account the age of the receiver. When listening to CW, careful tuning and the use of either the 300Hz or 100Hz filter positions cuts out interference. It is also possible to receive SSB transmissions using the 1.2kHz filter position, thereby reducing QRM from any adjoining station to reasonable levels. The quality of the audio is good enough to listen to home or overseas broadcasts, using an

external speaker and the 1W 3 ohm output.

It is possible to receive and print good quality fax weather pictures from various stations and for considerable periods of time without any need to adjust the tuning. One reason for this is the strength of the chassis.

I had occasion to remove the base and side-plates of the receiver to clear an intermittent contact in the AERIAL RANGE MHz control, and it really was an eye-opener. Aluminium castings at least 1/8in thick contained all the main stages of the set; a great difference from modern units.

Fig 1: The RA 117E block diagram



Conclusion

I hesitate to say it but having been spoiled by modern technology, I missed the availability of some memories! It is interesting to note that all the valves in the receiver, twenty-four in all, are still current types and are available from suppliers who advertise in amateur radio magazines. At the time of writing this article, a complete set of new valves costs only £48.20!

For anyone who, like me, is fond of classic machinery, I suggest that if you find a Racal receiver for sale, then buy it. Your time won't be wasted and you will enjoy operating it.

NEXT MONTH

Amateur RADIO

Don't miss the February issue on sale 25 January

■ The User Review

Ken Michaelson G3RDG reviews the Philips D2935 World Receiver

■ An American Adventure

Trevor Morgan GW4OXB travels to the USA and visits the ARRL Convention in Virginia

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TS-140S £862

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For all that's good in Amateur Radio – including advice!

Although most folk think of us as the Emporium in Matlock and enjoy coming to see us, we do appreciate that travel can be difficult these days, particularly for those who have to drive (sorry, park) on the M25. That is why we have branches around the country. Each branch carries a full range of everything that we stock and sell, and is run by an experienced radio amateur who is ready with the same good advice and assistance which we try to offer at Matlock. Why not call in and have a word with Sim, GM3SAN in Glasgow; Hank, G3ASM in Darlington; Tony, G4NBS in Cambridge; Ceri, GW0CJB in Barry (our new branch transferred from Cardiff); Dave, G3IKG in Eastcote, London; or Colin, G3XAS in Bournemouth. You could of course pop in and talk to our front line manager Richard, G4NAD here at Matlock, ably assisted by Bill, G8LXN. Lurking behind the scenes you might find Alan, G3MME or myself G3PCY, or even Bill, G3UBO on a flying visit. For technical queries you might find yourself talking to Barrie, G8OTY; or Rob, G8MPT; or Keith, G8YQX; or Bob who preceded Keith by getting G8YQL. In a technical world of his own we have John, who doesn't have an amateur licence, but with an MA from Cambridge he hardly needs one, does he?

You may get the impression that I'm trying to tell you something – and that is the simple fact that we know what we are doing when it comes to radio communication, and you won't get better advice anywhere in Europe.

73. John Wilson, G3PCY/5N2AAC

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DX DIARY

News for HF operators compiled by Don Field G3XTT

Happy New Decade! As we enter the '90s it is hard to predict just how HF operation will develop. Packet radio and other data modes will undoubtedly play an increasing part in our activities, not only as HF modes but on VHF in the form of DX alerting nets and giving us 'on line' access to propagation predictions, QSL information and other useful facilities.

Computers will also have an impact on our HF DXing. Most HF transceivers are now fitted with an RS232 interface to allow remote control which, in the extreme, will allow HF operators to site their shack on a remote hilltop farm and operate it via UHF link from their suburban home. And, of course, software for contest logging, propagation predictions, antenna modelling and much more is already commonplace.

Bad news for HF? I don't know. I suppose plenty of people said that when SSB started to take over from AM (and as all my early phone excursions on to HF were on AM I suppose that dates me!). To enjoy these new developments the secret will be to rise to the challenge, and take advantage of them to improve our operating success. In any case, some of them may well be counterproductive. An 'alert' via VHF packet of a rare DX station will bring an instant pile-up of ridiculous proportions, so the secret to success will be careful listening to be in there and work the DX before the armchair DXers are alerted to what is about.

Of course, some of the challenges on HF remain as mundane as ever. While band conditions during the CQWW SSB contest were a great improvement on the preceding week, the same couldn't be said for the weather. I know of at least three UK amateurs who lost their antennas mid-contest because of the high winds, and those of us operating GJ6UW from a cliff-top site in Jersey struggled to keep the antennas aloft in winds of 100mph!

For the most part we succeeded, setting a new British Isles record for the multi-single category (and beating the previous British Isles multi-multi record into the bargain). I don't know how other UK amateurs got on, though I understand GW4BLE yet again achieved a high score in the single-operator all-band category.

November DX

Just before the October contest there was a massive solar flare, and conditions

were still disturbed during the contest although many Pacific stations were worked, even on 10m. Over the next few weeks the sun settled down nicely, and 10m produced good signals from A35ML, ZK2HP and others.

At the other end of the spectrum, 9M8AX and ZS8MI (Marion Island) were worked on topband in early October, which is an encouraging sign.

Iris and Lloyd Colvin showed up as 5U7QL (Niger) at the start of their latest tour which will take in Burkino-Faso, Bahrain, New Zealand and Tahiti, with three to four weeks at each stop-over.

Erik SM0AGD showed up from 3C (Guineau) and S9, using his usual operating technique of listening on several spot frequencies such as 28510, 520, 530 etc.

Most wanted countries

The American **DX Magazine** recently published the results of its 1989 Countries Wanted survey. Not surprisingly, Albania and Burma continue to top the list. Albania was last on in 1971, while Burma hasn't been activated since 1965 when Don Miller's operation took place (and there has since been some doubt about whether he was actually in the country). Bouvet Island ranks third for European DXers, though hopefully the Norwegian and US expeditions should push Bouvet well down the rankings. Bouvet was last on the air in March 1979.

The rest of the top ten, in descending order of rarity (with date of last activity in brackets) are: South Sandwich, PDR of Yemen (1967), Bhutan, Afghanistan (1973), Spratly (1983), Malpelo (1983) and Bangladesh (1981). There is no sign of many of these putting in an appearance in the near future, though we can remain optimistic. One bright spot, though. The Colombian club is hoping to make a big effort from Malpelo this year.

The European list also shows high rankings for a number of Pacific countries such as Midway, Palmyra and Central Kiribati which are much lower on the list for US and Japanese DXers. This is a reflection of the difficulty of working the Pacific from Europe. Hopefully DXpeditioners in the Pacific will take notice of this, and make a special effort for Europe.

DX news

The Norwegian operation from Bouvet Island should be in full swing by the time

you read this. The latest plans had them establishing two quite separate operating locations on the island to give worldwide coverage, and it was hoped that additional operators would join the operation to take advantage of the five sets of Icom equipment at its disposal. The callsign should be 3Y5X.

The plan was to operate all bands and modes, but with the prime aim of giving out a Bouvet contact to as many as possible, rather than just helping the 'top guns' to fill out a few more slots.

At the time of writing, substantial funds had been promised from Japan to help the operation get off the ground. Contributions from the UK amounted to less than 0.4% of the whole, though the fund-raising exercise by G4DYO of the DX News Sheet should have helped boost this figure.

The Grupo Argentina DX will be putting some unusual prefixes on the air during January, February and March. These will include L73GADX, and twenty-six stations signing LQ1DX to LQ26DX.

K3RV is reported to be in Liberia for a two-year assignment. He will sign EL2CX.

OH2MCN is in the Pacific right now, and should show up from Fiji as 3D2VD from 31 December until 3 January. SM7PKK, also in the Pacific, is due to appear from Tuvalu (T2) from 10 to 23 January.

All these dates for Pacific operations should be taken with a pinch of salt. Travel between the various islands seems to be something of a hit or miss affair at the best of times, and dates can easily change as boats are delayed or planes cancelled.

Within these limitations, the various Scandinavian operators who are in the Pacific this season have been doing a good job and have been paying attention to the needs of European amateurs to work these rare ones while propagation is favourable.

WARC bands

Activity on 18 and 24MHz has increased considerably of late, helped by the release of the bands to amateurs in the USSR. During October UK amateurs were able to work KH6JEB/KH7, 5W1VB and other exotic DX on 18MHz.

These bands also lend themselves well to long ragchews because interference levels are low and there is an absence of contest activity.

USSR bureaux

Geoff Watts, well-known for his various DXing aids, has produced a new list giving full address information for the many QSL bureaux which are now springing up in the individual regions of the USSR. The list costs 25p in stamps and complements Geoff's existing Oblast list (costing £1.00). Geoff's address is 62 Belmore Road, Norwich, Norfolk NR7 0PU.

Congratulations

Only one UK amateur gained DXCC in the October listings in **QST** Magazine, and that was G0FUS. However, the same issue carried the results of the 1989 ARRL DX Contests in which Al G3FXB came world sixth (and highest placed European) in the CW leg and Steve VP5T (G3YDV) was world third in the phone leg.

Other notable UK scores were achieved by Ian G3WVG, who operated as GW4BLE to come world third on 10m CW, and Stuart G4CNY, who was world fifth on 15m CW and world fourth on 15m phone.

Contests

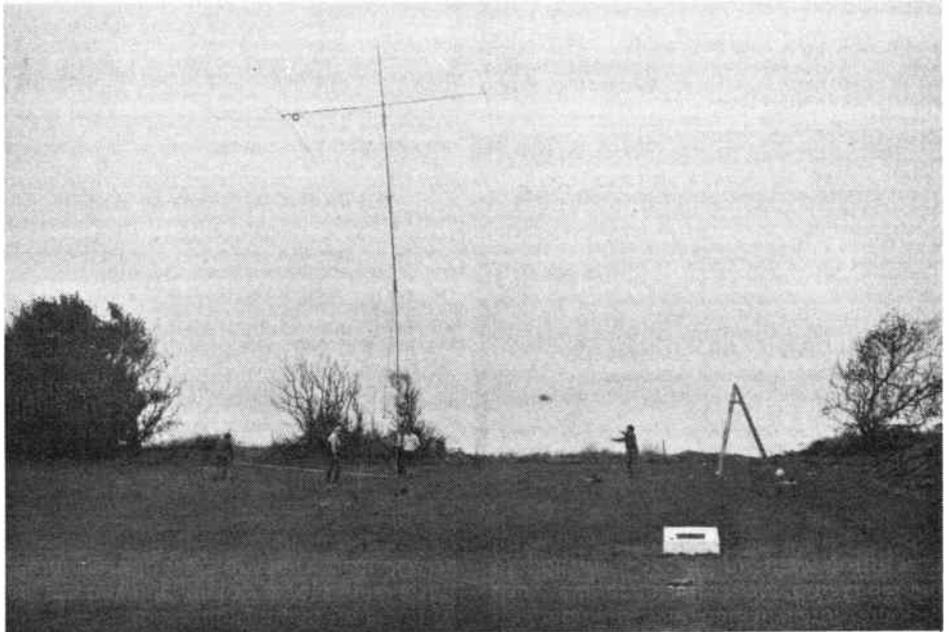
A number of national contests take place during January, but the main one is probably the UBA Contest, the CW leg of which is on 27-28 January, and the phone leg on 24-25 February. The contest runs from 1300GMT for twenty-four hours, covers 10, 15, 20, 40 and 80m, and has single-operator, multi-op and QRP categories. Exchange RS(T) + serial number.

Contacts with ON, DA1 and DA2 stations score ten points, with other EEC stations three points and with the rest of the world one point. All Belgian provinces and prefixes, plus all EEC member countries, count as multipliers, making a total of forty-two per band. Logs should be sent to ON6JG within thirty days after the contest.

An award will be issued to the highest scoring station in each class in each country and EEC trophies will go to the single-op, multi-band winner in each leg.

The other major contest is the CQWW 160. The dates for the CW and SSB legs are 26-28 January and 23-25 February respectively. The contests start at 2200hrs on the Friday and end at 1600hrs on the Sunday. There are single and multi-op categories. US and Canadian stations send RS(T) plus state or area. DX stations just send RS(T) unless there may be confusion about their country.

Scoring is two points for a contact with your own country, five points for other countries in the same continent, and ten points for inter-continental contacts. The multiplier is the total of US states, Canadian areas and DXCC countries (not including the US and Canada). Maritime mobile contacts also count as multipliers. Logs should be sent to Don McClenon N4IN.



The 40m beam goes up at GJ6UW in Jersey

Awards

This month I want to mention some of the awards available for working South American stations. South America is one of the easiest parts of the world to work from Europe, though getting the QSL cards can be rather more difficult.

The 3ZN Diploma is issued by the Bogota Section of LCRA, Apartado 584, Bogota, Colombia, for working 20 HJ3 (novice) stations since 1 January 1988. The fee is four IRCs or \$2.00.

The HK4 Diploma is issued by the Medellin Section of LCRA, Apartado-Aereo 51900, Medellin, for contacts with fifty different municipalities/towns in Colombia.

The HK5 Diploma, issued by the Cali Section of LCRA, Apartado 6149, Cali, is for contacting five HK5 stations since January 1957.

The Diploma Fundacion de Cali (same address) is for contacts made on 25 July each year (commemorating the founding of Cali). Work the three official stations HK5VD, 5J5VD and 5K5VD, plus any other five HK5 stations on the same date.

The Diploma HK7 issued by the Bucaramanga Section of LCRA, Apartado Aereo 57, Bucaramanga, is for contacts with six HK7 stations plus the special station HK7LRB.

Fee for all Colombian awards is \$2.00 or equivalent.

The Radio Club of Valparaiso, PO Box 3016, Valparaiso, Chile, sponsors a series of awards. There is no set fee but, again, a figure of \$2.00 or more is suggested to cover costs. The Southern Cross Award is issued in three classes as follows:

Class A - contact three Chilean territories (see below) and fifteen other countries in the southern hemisphere.

Class B - five and forty-five as above.

Class C - six and sixty as above.

(Chilean territories are CE1-8, CE9 Antarctica, CE9 South Pole, CE0 Easter Island, CE0 Juan Fernandez, CE0 San Feliz and CE maritime mobile stations.)

The Valparaiso Award is for contacts with ten Chilean stations, the last letters of whose calls spell the word VALPARAISO. The contacts must be spread across at least eight of the Chilean call areas.

Finally, the Zone 12 Award is a handcrafted copper plate award granted to all stations who work twelve different zones, on any band, of which one must be zone 12. The cost is \$5.00 to cover postage, from Radio Club de Chile, Casilla 13630, Correo 21, Santiago de Chile, Chile.

QSL cards are not required for any of the awards I have mentioned this month. Send a GCR list instead. In other words, a list showing details of the contacts concerned, signed by two other radio amateurs or an official of a recognised radio club (normally your national awards manager).

That's it for this month. Providing the sun doesn't get too restless we should be in for a good year on the HF bands.

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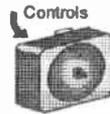
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DESIGN

AND USE OF DIP METERS

In the third part of his series Joe Pritchard looks at using a dip meter as a passive instrument

As we've seen in the first two articles in this series, the dip oscillator works on the simple principle of indication of absorbed energy. The meter can be used in two ways, either as a passive instrument or an active instrument.

When used passively, the dip oscillator acts simply as an absorption wavemeter (Fig 1) and provides no RF energy itself. To use a meter passively thus requires a source of RF energy at the frequencies of interest, and the meter simply absorbs some of the energy and uses it to actuate a meter.

In the active mode, the oscillator generates RF energy and the meter indicates energy absorbed from the RF oscillator by the circuit under test.

The dip oscillator can be used only to measure circuit parameters of components or circuits that exhibit some degree of resonance within the range of frequencies covered by the meter. A dip meter is not used to measure components which are purely resistive, although components with capacitive or inductive reactance can be tested with a dip meter if the component concerned is formed into a resonant circuit first, as we shall see later. Circuit elements such as transmission lines, aerials or feeders may also be tested with dip oscillators because these exhibit 'lumped' resonant characteristics.

The only other comment to make about the types of circuit examined by dip

meters is that they need to exhibit a good enough Q to absorb energy at the frequency of interest.

Use as a passive instrument

When used in the passive mode, the dip meter is not generating RF. Most commercial dip meters have a setting for passive use, often called 'Wavemeter' or 'Diode' on the control of the meter. The sensitivity control will often have an effect on the size of the meter deflection, but the instructions you get with your dip meter will indicate whether or not this is so.

The most obvious use of a dip meter in passive mode is in testing oscillators or

frequency multiplier stages. Let's look at how we might use a dip meter to set up a simple transmitter driver, like that shown in block form in Fig 2. The oscillator is a crystal unit working around 25.2MHz, with a transformer coupling to a frequency doubler to give an output frequency of 50.4MHz.

Setting up the oscillator

The dip meter is set into passive mode, and an appropriate coil (covering 25MHz) is selected and the oscillator powered up. The coil of the dip meter can be positioned near to the 'live' end of the transformer coupling (L1) and the dip meter tuned for maximum deflection of

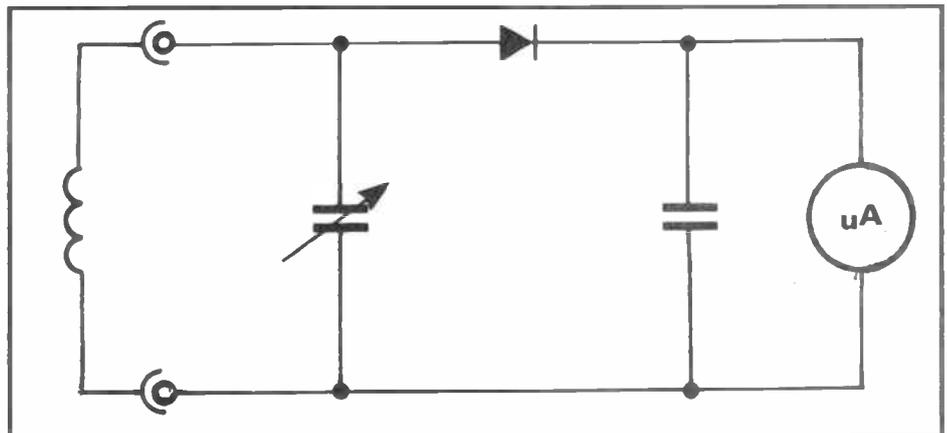
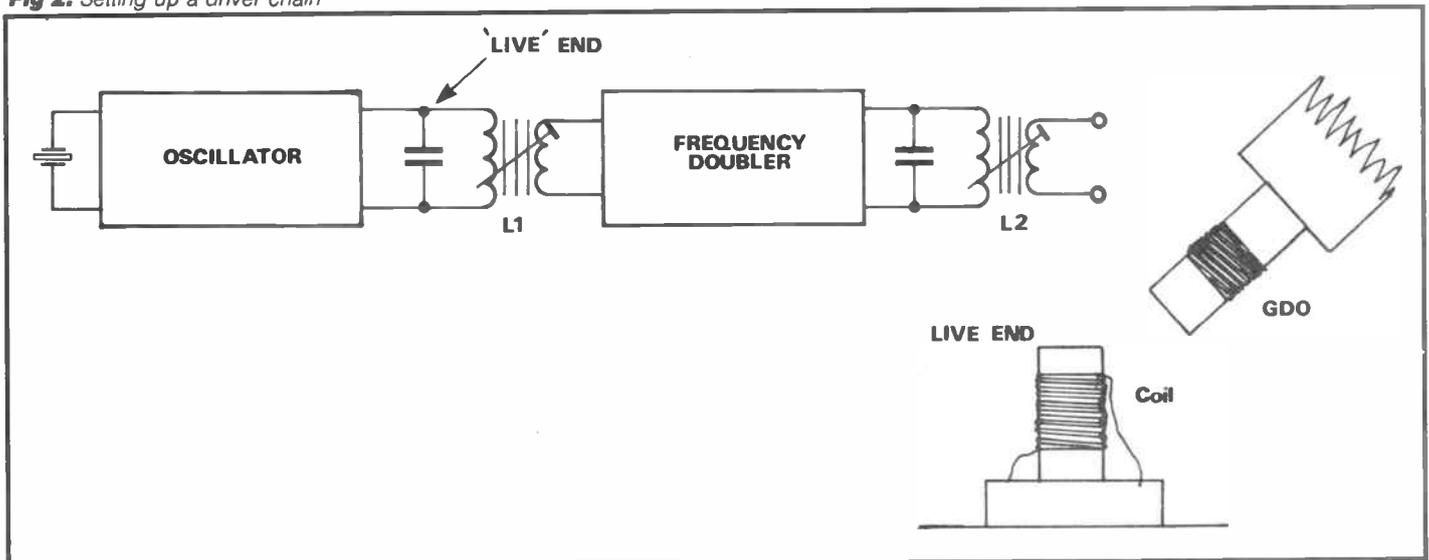


Fig 1: Typical absorption wavemeter

Fig 2: Setting up a driver chain



DESIGN AND USE OF DIP METERS

the meter. This deflection may not be too large in low power circuits, but will be detectable.

The accuracy of dip meters, by the way, isn't adequate for actually setting up a transmitter on the band; a crystal-controlled reference is needed for that, as per your licence.

Coupling between coils

The dip meter coil should not be too close to the oscillator coil, as the tighter the coupling between the dip meter and the circuit under test, the broader the 'dip' (or in this case, the peak meter reading) will be. This is because the tight coupling effectively reduces the Q of the tuned circuit, and in extreme cases overtight coupling between a passive dip oscillator and a circuit can cause changes in the tested circuit's behaviour. The coupling will be roughly proportional to the distance between the coils, and the closer they are the tighter the coupling will be. Of course, loose coupling will also give a weaker meter reading when used as a passive meter.

If you find it difficult to get responses, try altering the orientation of the dip coil with respect to the circuit under test. If all else fails, connect a piece of insulated wire to the circuit under test and loop it loosely round the dip meter coil to increase the coupling. This is *not* a good idea at higher frequencies, because the presence of the coupling wire will almost certainly detune the circuit under test!

Tweaking for maximum power

In this example, we need to tune the output transformer of the oscillator for resonance at the desired frequency of operation. In this case, this is 25.2MHz, but in some circuits the frequency selected here may be a harmonic of the crystal frequency. Whatever the frequency, however, the dip meter can be used to tweak the transformer resonant frequency to that required – this is one of those jobs that often needs three hands!

By using the meter, we can tune the transformer to the desired crystal harmonic frequency by making sure that the peak reading on the dip meter occurs at the expected place on the dial. This is quite important in cases where the

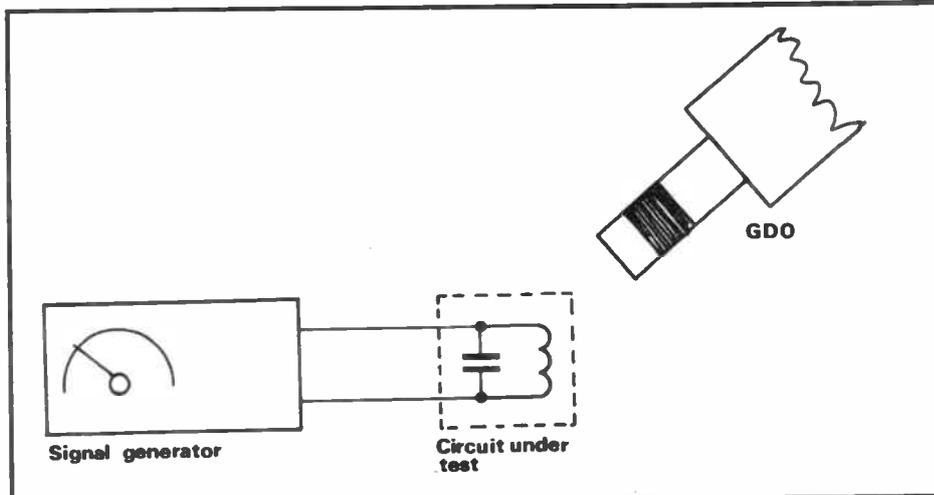


Fig 3: Using a signal generator

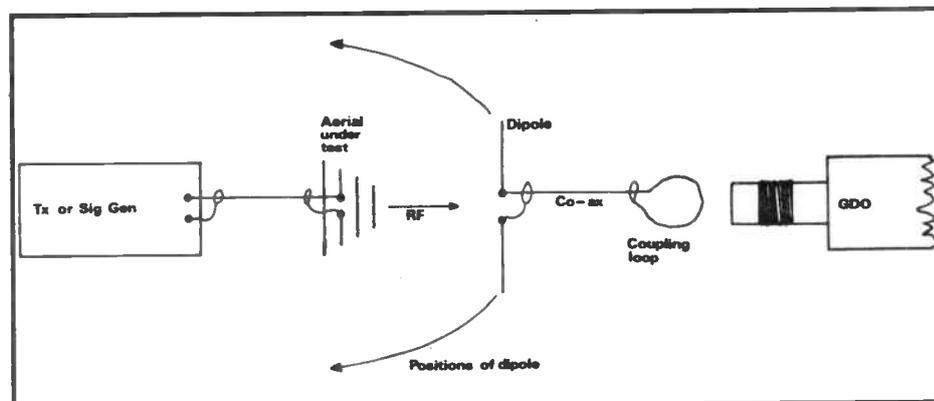


Fig 4: Checking directivity

oscillator may be generating considerable amounts of harmonic energy as well as the fundamental.

Frequency multiplier circuits

A frequency multiplier is simply an amplifier biased so as to generate harmonics of its input frequency. A tuned circuit at the output is then tuned to the desired harmonic. In the case described here, we are doubling the frequency, and so the output tuned circuit needs to be set to 50.4MHz. To do this using the meter in the passive mode, select a coil and adjust the dip meter to a frequency around 50MHz. The output frequencies

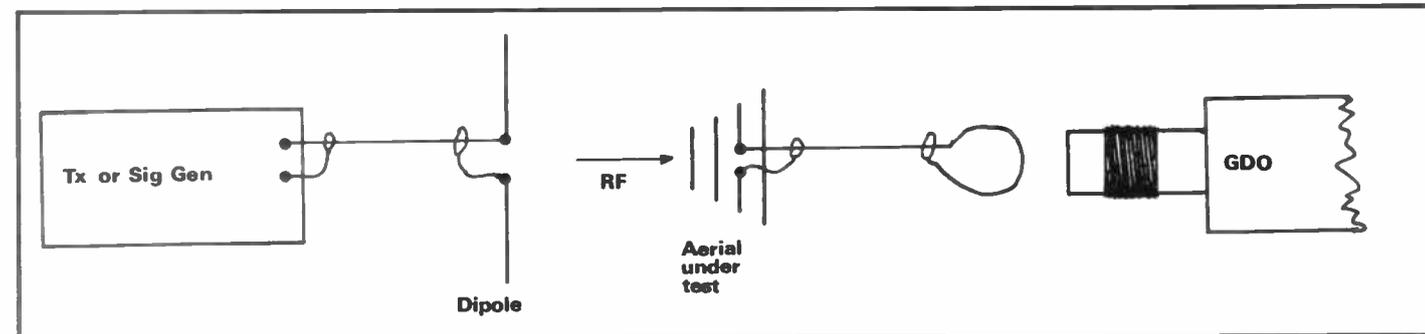
from the doubler will principally be 25.2, 50.4 and 75.6MHz, plus a few low-level mixer products and fourth and fifth harmonics.

We need to tune the slug of the output coil for maximum peak at around 50MHz, again taking care not to couple the two circuits too closely. Once this is achieved, you can tune the dip meter across a range of frequencies and check the doubler output for responses at 25, 75 and 100MHz; these should all be less pronounced than the 50MHz signal.

Use with a signal generator

You can use a passive dip meter in

Fig 5: Tuning an aerial



conjunction with a signal generator to test resonant circuits as shown in Fig 3. The techniques used are, however, similar to those used when just using the dip meter alone in an active way, so I'll leave discussion of this area of use until later in the series.

Use as a field strength meter

You can use a passive dip meter as a field strength meter to help set up aerials or the output circuits of transmitters, as briefly described earlier. One point to note about using the dip meter as a field strength meter is that the response is likely to be non-linear; that is, a change in signal strength of the same magnitude but at different levels of signal strength is likely to give different changes in the meter reading, thus making quantitative measurements difficult unless you can absolutely calibrate the meter.

When used to set up aerials, the following points need to be taken into account.

Because we're using the meter in passive mode, a source of RF will be required. This is typically going to be a transmitter which should be radiating. This should be of as little power as is practicable - a few hundred milliwatts is often more than enough.

There are two approaches to using the

passive meter in this role. The first is where the aerial under test - say a VHF beam aerial - is connected to the transmitter and the dip meter is connected to a dipole as shown in Fig 4. This set up allows us to explore the directivity of the aerial, as described below, but isn't too good for the initial setting up of aerials, as you might end up pushing RF into a mismatched aerial.

Fig 5 shows the 'opposite' way of doing things; the aerial under test is loosely coupled to the dip meter and the transmitter is connected to a simple dipole to radiate a signal.

In either case, the tests must be done so that at least a couple of wavelengths of distance are put between the two aerials, and both aerials should be a good distance from any earthed conductors. In a perfect world, of course, we'd test the aerials in their operating positions.

Checking directivity

This is done with the transmitter feeding the aerial under test, with the dipole connected to the dip meter being placed at different points around the aerial under test. A simple graph can then be plotted of signal strength against position.

One point to note is that the meter

reading needs to be taken with you as far away from the dipole as is possible, as otherwise your presence is likely to detune the dipole!

Initial setting up of an aerial

If a new aerial has been constructed, a passive dip meter can be used in conjunction with a transmitter to fine tune the aerial by adjusting element lengths etc. The dip meter is loosely coupled to the aerial under test, and is positioned a few metres away from a radiating dipole at the frequency of interest. You can now adjust the aerial for maximum meter reading, again taking care that you yourself do not detune the aerial under test by being too close to it when making the meter reading. It's again important to remove other conductors from the immediate vicinity of the aerial under test.

Checking for RF leaks

We're supposed to check our station for sources of RFI occasionally, and one way to do this is to 'sniff around' for RFI using the dip meter as a field strength meter when transmitting into a dummy load. For example, most homebrew gear will give a few out of band signals which are too low to cause problems, but you could always try and reduce them.

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SECOND-HAND

by HUGH ALLISON G3XSE

Valve extender cards

I recently bought a Solartron CD1400 'scope at Cranfield, not working, for £3.00. Don't know why I bought it really, I suppose 'cos it was cheap. Although it's an old valve 'scope it is a true dual beam, ie, there are two guns in the tube; it ain't chopped or alternate. I've no idea what the bandwidth is supposed to be, but those that come my way seem to fade away at about 10 or 12MHz nowadays, though that could be a feature of their age.

The score is Solartron two, Allison nil. In other words, it has two faults and after twenty minutes I've not found the sources of either of 'em. The faults are no timebase and no X amp (trace exits stage right PDQ). I couldn't be bothered to sort out the circuit diagram - well buried after years of non-use.

I decided to tackle the lack of X action first, one anode in the amp (and consequently X plate) is at 30V and the other at 300V. Valves out, both 300V. The one at 300V obviously ain't turned on. I try to go round the valve pins, valve in, from the top, measuring the volts with an avo. This is because I can't get to the underside, you understand. Trouble is the bloody valve needs to be out of its socket by an eighth of an inch to get the probe in and it keeps falling out.

The odd rude word slips out as a passer-by stops to enjoy the scene. 'What you need,' he says facetiously, 'is a valve extender card.'

I think, why not? Less than a minute later I've soldered a B9A plug to a B9A socket, and it's easy! Why have I never done this before? Bingo, no volts to grid one of the triode bit (we are playing with ECF80s - there are yards of 'em in a CD1400). Open circuit resistor. Score should now be Solartron two, Allison one but when I plug it back in the whole thing is up and running, one of life's little mysteries.

Contactors

These are 'bleepers' or pocket pagers. They are brown, measure 5in x 2in x 3/4in and are made by SRA in Stockholm, Sweden. They are freely available on the surplus market, priced from £2.00 to £5.00 tops. All of the examples I've come across still have an internal 6V Ni-Cad fitted and wired in - they seem indestructible, too.

What's the excitement? Well, these pagers are super little FM UHF receivers. As they come they are on about 415MHz, but 70cm operation is only a tweak away. The IF is 21.4MHz. The sensitivity is well below the microvolt and, no doubt due to the recent circuit design, they are vastly superior to a pocket phone.

The good news gets better. There is a proper speaker fitted, and recovered audio isn't too bad at all. Incidentally the button to 'bring in' the speaker, ie, tone call defeat is often blanked off - simply lever out the small plastic bung on the right-hand side near the top.

The ON/OFF switch is located on the front of the pager, just below the nameplate. The dual action switch on the side is the speaker/vibrator. The vibrator is to prevent the machine disrupting, say, a meeting or concert when the 'beep' might distract others. In the vibrate position the thing shakes when activated.

For the more adventurous, I've also come across the tone signalling base station bit - often for sale without a matching transmitter. These 'big phone' looking things are famous brutes; inside there are processors and other ICs galore. Again, dirt cheap - a couple of quid should bag you one. Perhaps they're ideal for a contest group or Raynet etc.

Good modern kit, well designed and available at a reasonable price, worth looking out for.

Stupid

It's amazing how totally and utterly stupid one can be at times. At the Harlow Rally I bought a Yaesu FRDX400 receiver, not working, for £20.00. A CB'er in the village I live in had expressed an interest in listening to the amateur bands. He didn't know what he wanted to listen to, locals on 2m or the DX stuff on 14MHz SSB, thus the FRDX400 seemed ideal.

This receiver has more HF bands built in than you can shake a stick at, plus 2 and 6m and a built-in FM adaptor.

I must also admit to being a bit of a skinflint. I was going to let him borrow it on free long term loan, but I couldn't bring myself to invest more than £20.00 in his education - not really the right attitude but, at the time, I didn't know him too well and he might have done a bunk with it!

Anyway, dead FRDX400 on the bench. Wires off all over the place. I soldered 'em back on and followed the signal through from the aerial socket with the 'scope. Did I mention that there was a faint response on the right frequency to a 1V input signal?

All went well through to the last IF: volts, IF flavoured, on grid, lots. Anode? Nothing. Strange waveform though, 'scope was on ac coupling. I left the 'scope probe clipped on the anode and flicked the 'scope input coupling from ac to dc - trace jumped off screen moving vertically. I wound the attenuator (volts/cm) switch round to 50V/box to measure the HT on the valve. I thought to

myself, where is the trace with no input? Better put it down to the bottom of the screen. Here comes the dumb move, I heroically switched the 'scope input coupling to ground.

I was really startled when smoke started coming out of the receiver. Big white clouds of it. I'd done nothing wrong, something must have blown. My lightning reactions were demonstrated as I switched off the mains.

Suddenly I saw the problem. A times one (x1) probe into a 'scope and the input was switched to ground. I'd shorted the HT out through the IF coil via the 'scope - lucky for me I'd only burnt out a decoupling resistor. I've been repairing stuff for more than twenty years and have never shorted things out with a 'scope probe into a grounded input. I've been living on borrowed time! I thought *all* 'scopes disconnected the input when in the ground position.

The FR400?

The IF coil had a shorted turn. I couldn't find a replacement so I used an old 455kHz coil from a scrap mains, valve receiver. The can didn't fit, but the coil came off the former. I then fitted the FR400 former, which is a cheap repair.

Saisho SW5000

This is a 'bit bigger than a library book' sized, synthesised receiver. As well as your normal domestic stuff, long wave, medium wave and VHF (also in stereo through the headphones only), there is short wave. Short wave can be the 'domestic' or broadcast bands, where you step from band to band, or continuous tuning, where you get the amateur bands as well. You can use the receiver's tuning knob or have direct entry via the keyboard.

The good news is that there is a BFO to enable SSB and CW reception, though with the 1kHz synthesiser steps you might assume that tuning in SSB is difficult. In action, it isn't. You soon get used to a 'tune it in as near as you can on the tuning then tweak the BFO' arrangement. Coverage is continuous up to 30MHz.

This rig is used with a ferrite aerial for long and medium wave, up to about 2MHz, then a telescopic array for the rest. There is a switch for an external aerial, plus an appropriate socket. The changeover at 2MHz from one aerial to the other may be the cause of them being a bit down about this frequency. I've seen portables with more sparkling reception on top band and/or HF marine, though things have definitely perked up by 1.6MHz (going lower) and 2.5MHz (going up).

The other moan is a bit of second channel; in comes medium wave stations, admittedly well down, when you are searching about 300kHz. That's it, please remember that nothing is perfect and, viewed against what the set is capable of, these complaints are small indeed.

On 14 and 21MHz, wow! There is excellent reception of respectably weak signal SSB stations; they roar in, on the rig's own aerial, just sitting in the garden. Batteries are U2 sized and last forever.

Prices? New ones are still available for about a ton, give or take the odd 'sale'. Second-hand I've seen them sell at £35.00 to £55.00.

Doll's cookers

No, don't laugh. I'm perfectly serious, now let me out of this straight-jacket. These are small boards, about 3in square, which contain a sound synthesiser chip, plus an LM386 audio output chip. The board is fairly distinctive, 'cos it has eight 1in high pins in two rows of four. It is designed to fit into a plastic cooker moulding, and all the kid has to do is put on a pan to get various cooking noises out of it. The different sounds come about by each pan having a conductive surface on its underside, the different resistance causes different sounds. Its attraction is that the boards are dirt cheap, often 10p a go, and I've even haggled the price down to 5p for bulk buys. They seem to be available in vast quantities and I've bought them from several traders.

What use are they? Well, after the initial fun of firing them up with a resistor soldered across two pins (4.7k is a good place to start) and leaving them running under seats in friends' cars, in fridges, behind TVs etc, the attraction of the LM386 becomes more interesting. This is conveniently positioned in one corner of the board and a little delicate surgery with a hack-saw will cut off a very useful fully componented, ready to work, postage stamp-sized, audio amplifier, working on supplies running from 5 to 12V.

People seem to specialise in bringing

me small units with no spare space and dead, unobtainable audio chips, pocket monitors, portable radios, transceivers, and the like. These boards are a godsend; just wire in an earth, a rail, one wire up the wiper of the volume control – the last off to the speaker – and the thing is repaired. I don't know why these boards were scrapped, nearly every one works first time; those that don't have the speaker coupling capacitor (220µF or greater) missing.

Zycomm FM26:U

These are FM UHF 'military style' hand portables. Most are army green coloured, and the case is metal. Rugged? I'll say, I bought some at Cranfield and gave one to my small son to carry back. He ran back to the van, 200yd away, dragging it by its strap along the ground (a runway perimeter track). When I examined it later there were only a few chips on the paintwork and the thing worked perfectly.

So what are they? The PA transistor is a 2SC652. This is rated as 750mW up to 800MHz, and makes a mockery of the stated '5W out' claimed by some dealers. All the examples I've examined seem eager enough to give about 1W, but I wouldn't push it any harder. 70cm is only a good tweak away after adding the appropriate crystal.

The receiver is a dual conversion superhet, 21.4MHz first IF, 455kHz for the second. It seems keen to do about the microvolt; quite reasonable.

Sure, they are old and big – 9 × 3 × 2in, but they take a row of standard pencil Ni-Cads and are easy to work on – plenty of room. By the way, the quaintly labelled LED 'Battery Empty' triggers on below 9V.

No crystals, ex service, they cost from £15.00 to £25.00, which seems to be the going rate. A mobile mount with built-in charger is available and adds a few quid to the price. Fully converted to 70cm, with some crystals of use to you, perhaps £35.00 tops. A good, solid, reliable and well made bit of kit that you could bang nails in with.

Cranfield boot sale

Still coming up, this rally was generally agreed to be not as good as Old Warden but a good close second. The pitch size given was extremely generous, probably about 20ft long for each entrant and there was more than enough room to get about. Quite a few traders sold out within an hour or two. Cranfield is a very active airfield and there was plenty to watch in the skies as well as in the selling area – parachutes, helicopters and vintage aircraft all buzzing about.

There were bargains galore available from a long line of car booters – too many over too large an area for an accurate count but I'd guess there were over 100 present.

Absolute A1 bargain of the day was a Bird thruline (with a selection of plug-ins) for £12.00. I turned down two offers of £100.00 before I got it back to the van!

Catalogue returns

Quite a few traders at rallies sell the catalogue returns stuff – kettles, radios, irons, hair-dryers, and the like. A lot of them have personal stereo cassette players, often at reasonable prices, say a quid or so, sold as seen, ie, not working.

These normally contain two chips: one is motor speed control and the other is for the audio – the BA3506A is common. The volume control is only a single pot, yet it controls both channels. It also feeds a dc level which the chip uses to set an audio attenuator, one in each channel. Ditto the graphic equaliser, it's all done with dc levels. The 'top' of the dc level is often obtained by a resistor of a k or so from the rail, decoupled by a couple of hundred µFs, or thereabouts.

For some reason this electrolytic has a charming tendency to go short. No voltages on the pot, the chip thinks no volume out is required, and the thing appears dead. The number I've had in where people say 'There's no volume so I've changed the chip but it still doesn't work.' A few seconds with an avo, 2.5V dc range, across the volume pot (look for roughly 1V) and the wasted expense of that new chip could have been saved.

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STARTING ON 10GHz

Part Two

by Glen Ross G8MWR

First of all let me explain what can be achieved using cheap and simple gear and describe the type of head to look for. Remember that we are using the gear with a very small aerial system, so we are talking ranges of only a few miles.

The head shown in **Fig 1** is readily available at rallies. The longer section contains the Gunn oscillator which acts as both the transmitter and receiver local oscillator. The shorter section contains the mixer diode and decoupling capacitors.

Limitations

These assemblies are coupled to a small horn aerial with a gain of about 4dB. This is where the major limitation comes in because it is more usual to use a dish aerial with a gain of around 30dB. Unfortunately there is little one can do to improve the aerial gain of these units, because they use a non-standard waveguide size.

The second, but easily overcome problem is that in the original application the unit relied on reflections from an intruder to provide the required local oscillator injection voltage, so without such external assistance the injection level may be too low.

Injection

To check if sufficient mixer current is available, connect a supply of 8V positive to the Gunn diode and then measure the current from the mixer diode to earth. This should be at least 0.25mA but it is likely to be a lot less than this. The mixer current can be increased by fitting a small metal plate to the front edge of the horn so that some of the signal is reflected from the Gunn diode into the mixer. The exact size and position of this plate needs a little experimentation. The idea is to use the smallest plate possible so as to limit the closing up effect on the end of the horn aerial.

On the band?

The head as supplied will be set on the alarm frequency of around 10.7GHz and will need retuning down the band to around 10.4GHz. The rough tuning screw will require about one and a half turns. A more accurate method is shown in **Fig 4**.

The metal plate is moved until a minimum reading is shown on the meter and the position of the plate is marked. The plate is then moved further away until another null is found and this second position is marked. The distance between the two points is then measured in millimetres, and the frequency in GHz

is found by dividing 150 by the distance in millimetres. Greater accuracy can be obtained by going through several nulls and averaging the distance. An accuracy of ± 10 MHz can be achieved with care, which is more than good enough when you consider the wide range of the electrical tuning system.

The circuit

The full system is shown in **Fig 2** and should not frighten even the most hesitant constructor. The basis of the circuit design is the 7805 voltage regulator and VR2, the tuning control. With VR2 set to zero ohms the regulator provides the minimum 5V supply required by the Gunn diode. As the resistance of VR2 is increased the Gunn voltage rises to a maximum of about 10V.

From last month's article we know that the frequency changes with voltage and, in fact, we get a tuning range of about 60MHz with this voltage swing. This is

equivalent to moving from dc to the 6m band! The current taken by the Gunn diode is around 100mA and this is why the regulator does not need a heatsink.

The modulator is built around a single BC108 transistor. The audio signal from the microphone is taken to the base of the transistor and an amplified copy is developed across the collector load resistor VR1. From here the signal is taken via a capacitor to the top end of the tuning control VR2. The superimposed audio feeds through the regulator, so causing the Gunn voltage to have an audio content. This 'wobbles' the frequency of the oscillator and so gives a wideband FM signal. By adjusting VR1 any amount of deviation can be applied. Simple, isn't it?

Receiving

The receiving circuitry employs an even simpler design. The only requirement is to match the output of the mixer

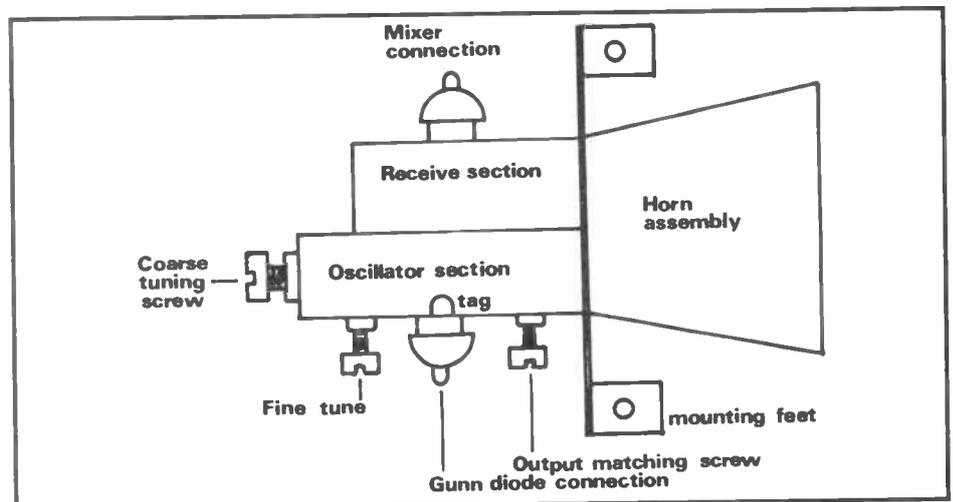
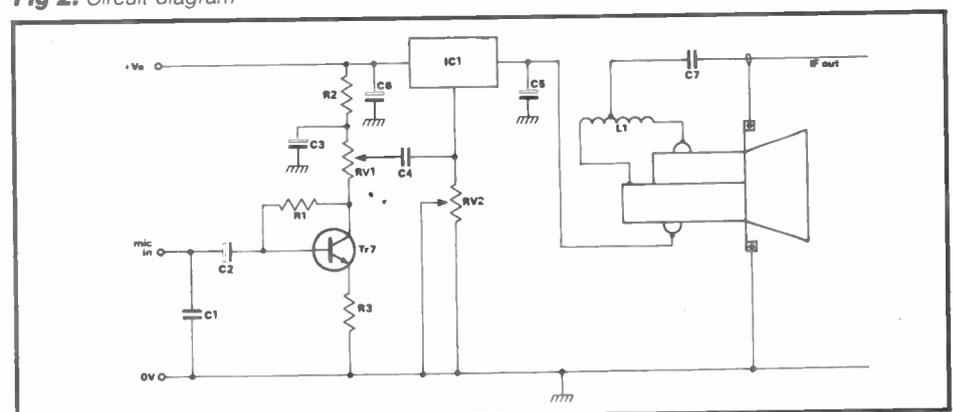


Fig 1: Microwave head assembly

Fig 2: Circuit diagram



diode into the receiver you are going to use as the IF strip. This is done using the coil marked L1 in the circuit diagram, which gives an impedance step-down ratio of 4:1. This coil and its associated output capacitor should be mounted directly on the head and connected to the BC receiver via a short piece of thin 50 ohm coax cable.

BC receiver

Three small modifications are needed to the broadcast receiver.

Firstly, remove the loudspeaker and mount it on the front panel of the box which contains the unit, extending the leads as required.

Secondly, remove the volume control; the PCB tags which went to the original control should then be wired to a suitable front panel-mounted control of the same value as the original one.

The third step is to remove the extendable rod aerial from the set and connect the inner of the coax from the mixer to the point the rod was connected to. The outer of the coax should be taken to the earth track on the PCB. The receiver should be tuned to a spot on the dial where there is no broadcast station breakthrough. **Fig 3** clearly shows the layout of the sub units in the case.

Setting up

Set up the two units at a distance of 20-30ft for the original tests and leave the units running for about half an hour to let the oscillators stabilise. Now set the Gunn oscillator voltage on one unit to about 7.5V, set VR1 to about half rotation and the volume control for no audio output.

On the second unit set the volume control to give reasonable noise output and VR1 slider to the end of the track furthest from the connection to the BC108. While one operator talks into the microphone of unit one, the tuning of unit two is varied until a signal is heard.

Adjustments

Adjust the deviation control (VR1) on unit one to obtain a well-modulated and distortion-free signal at unit two. Now turn up the volume control on unit one to give a low audio output from the speaker and, while still speaking into the unit one microphone, adjust the BC receiver tuning on unit one until you can hear your own voice in the speaker. You have now achieved full telephone duplex operation, and *no* receive transmit switching is required! Adjust the volume controls on both units for comfortable audio output.

The only thing left to do now is for the operator of unit two to speak into his microphone and adjust VR1 for good audio at both ends of the link.

More range

As you increase the distances you are trying to cover, you can gradually fine-

tune all the adjustments to obtain the best signals. Do not use too much volume on receive, otherwise your microphone will pick up the signal and send it round the system again. If taken too far this results in the familiar audio howling effect often heard on stage. The very best results are obtained if you use an aircraft-type headphone set with a built-in microphone, because there is no chance of howling and operating is a real pleasure.

Improvements

The sensitivity of this basic system suffers because of the poor noise figure of most cheap FM broadcast receivers.

However, this can be easily improved by fitting a low noise preamp close to the mixer diode. Any of the normal 144MHz circuits will work well, since all that is required is to add a couple of turns to the tuning coils so that the preamp can be tuned over the range of 90-105MHz. The tap on the input coil should be set about one turn higher up the coil than normal to allow for the higher impedance, about 300 ohms, of the mixer diode.

Conclusion

This article has described a very basic system which can be built cheaply. You will be moving into new territory and there is a lot to learn. Have fun.

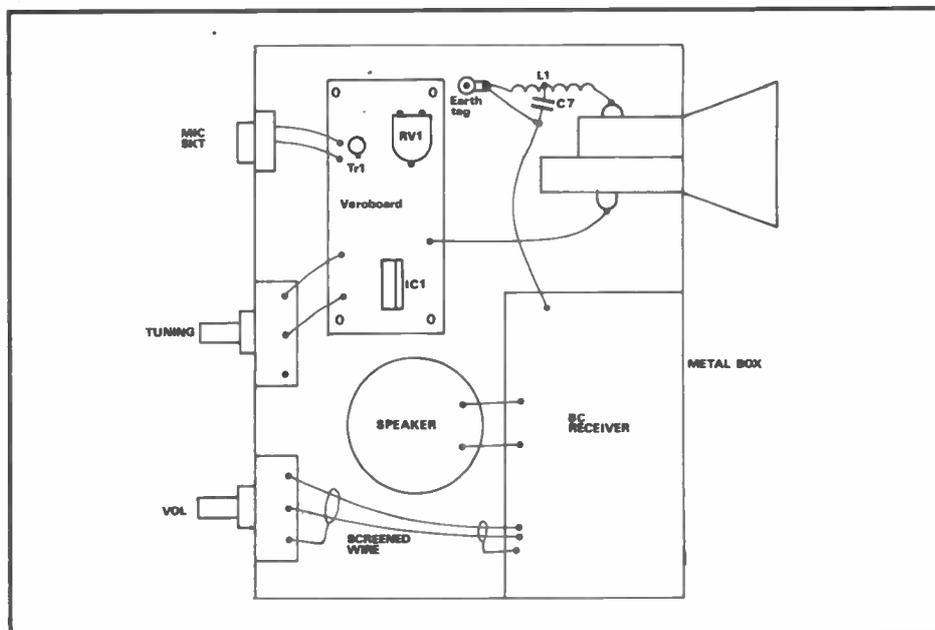
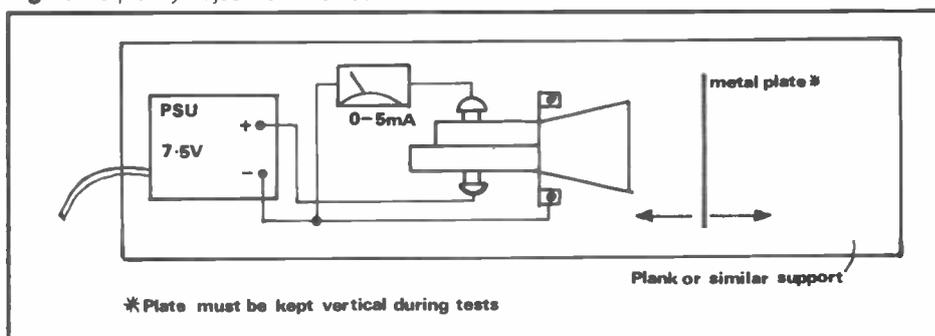


Fig 3: Layout of sub units in case

Fig 4: Frequency adjustment method

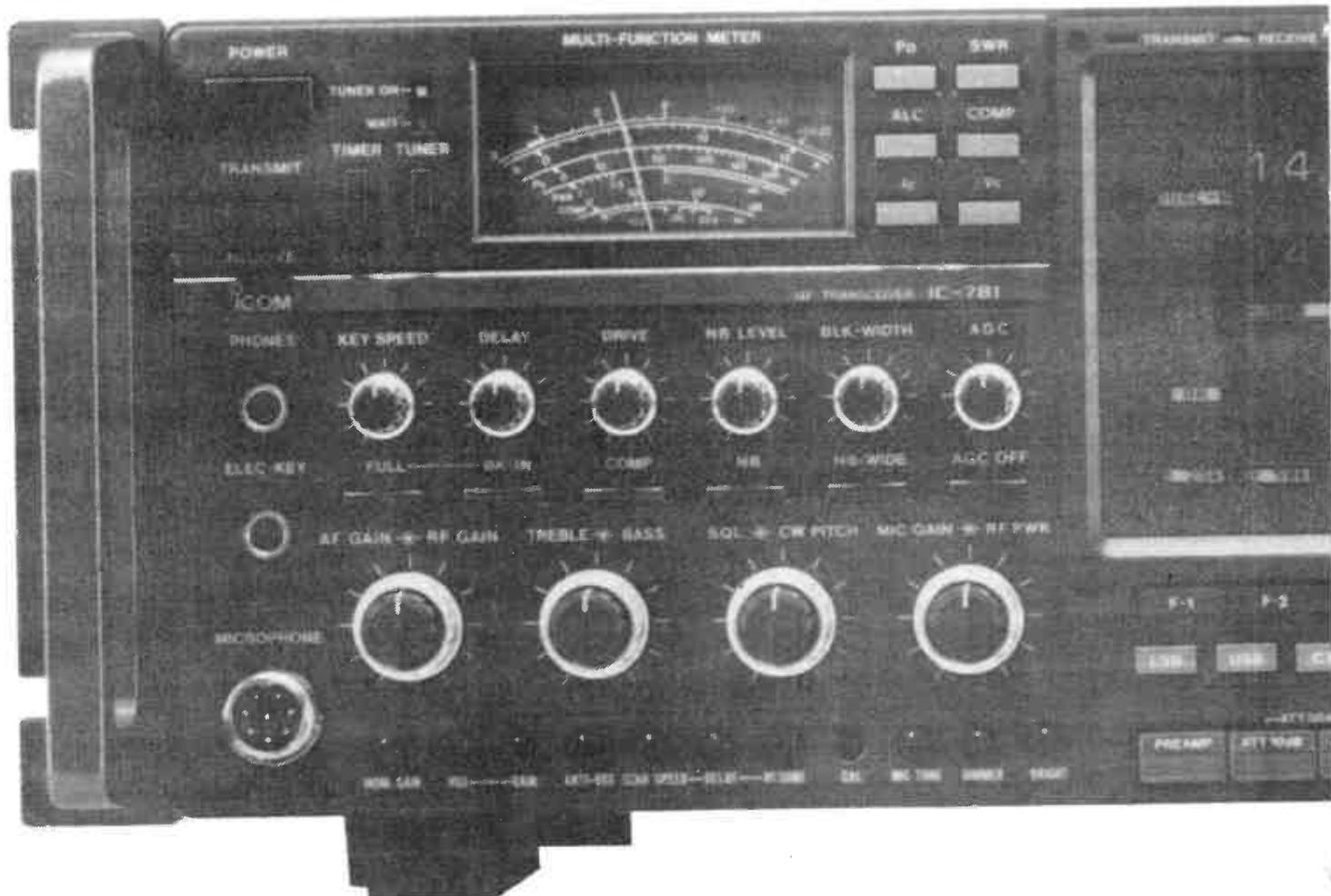


Components List

R1 1M Ω .25W	C1 1nF disc ceramic
R2 2700 Ω .25W	C2 4.7 μ F 16V elect
R3 270 Ω .25W	C3 220 μ F 16V elect
VR1 10k preset	C4 .47 μ F polyster
VR2 2k panel mounted	C5 2.2 μ F 16V elect
TR1 BC 108	C6 470 μ F 16V elect
IC1 7805	C7 1nF disc ceramic
L1 Twenty turns thin enamelled wire wound 1/4in diameter with a tap at ten turns	

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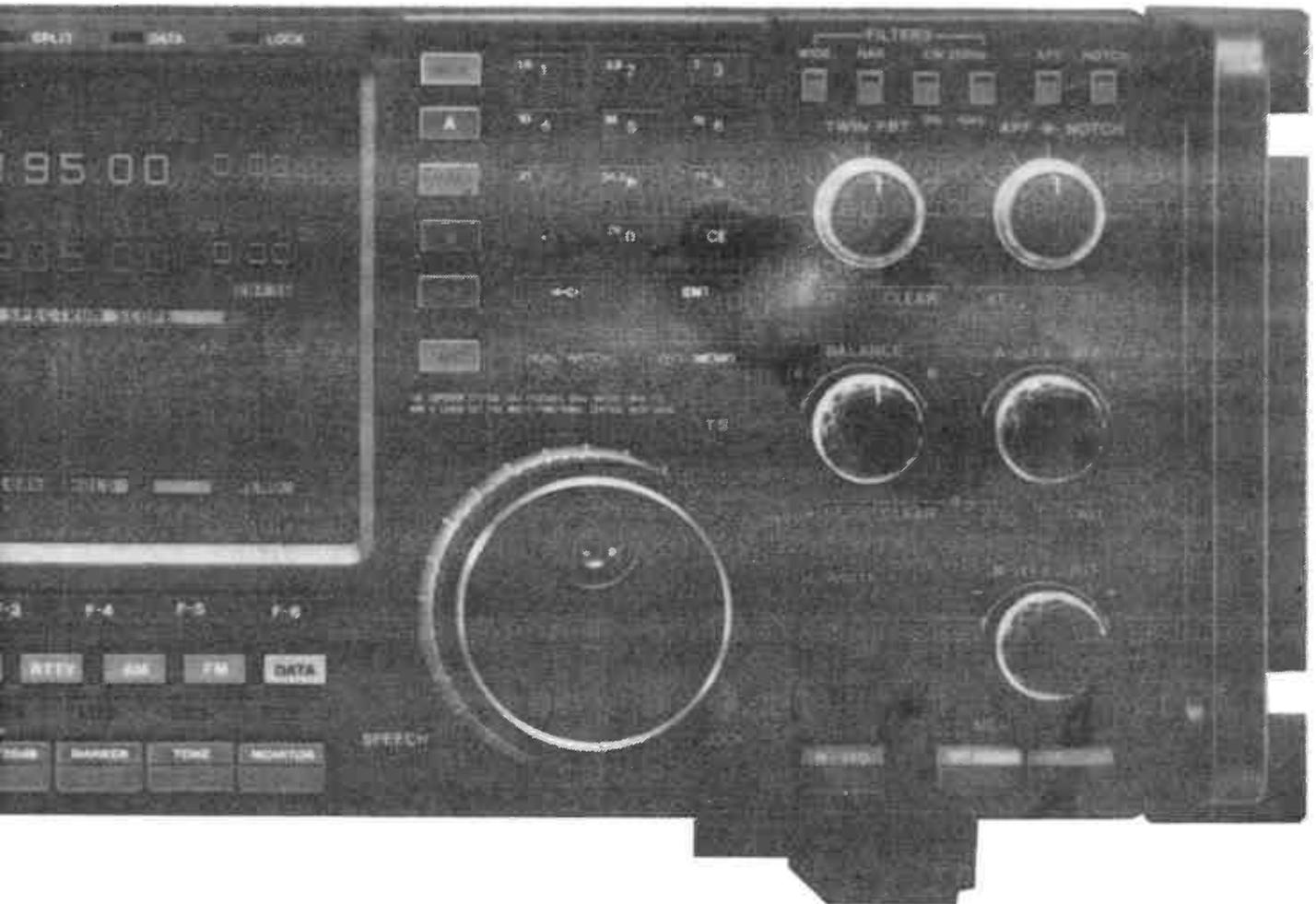
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Tony Smith G4FAI takes his bimonthly look at the world of dots and dashes

Key collecting

In the winter issue of **Morsum Magnificat**, the journal for Morse enthusiasts, Colin Waters G3TSS offers a personal viewpoint on key collecting which, he says, can become a passion to exceed or even suppress other radio-related interests. He offers useful guidance on starting a collection, suggesting that in view of the many types of key manufactured over the years, specialisation in one area is the best approach. He points out that simply acquiring keys is just the beginning.

'The excitement,' he says, 'can come from studying the ways different manufacturers had of achieving their ideas of ultimate performance... Obtaining a rare or unusual key may prove the easier part of the story; tracing the manufacturer and dating its production may prove a more difficult task... Few things are more frustrating for the collector than having a key and being unable to trace any information regarding it.'

Morsum Magnificat features many keys, old and new, and costs £7.00 pa for four issues. Full details from me, QTHR.

Unusual instruments

My own collection includes several unusual items. While I have some standard keys, and a couple of sounders (the original audible Morse receiving instruments which reproduced the sound of the sending key), I also have an early Air Ministry combined key and sounder. Fixed to a table this looks like an ordinary Post Office style key, but suspended underneath, through a cut-away in the table, are two solenoids with small rods connecting upwards to the key.

When wired up in a land-line telegraph circuit, the key is operated normally for sending and when a reply is received one just sits back and listens to the key thumping up and down as if controlled by an unseen hand! I would be delighted to hear from anyone having information

about this type of instrument and its original use.

First hand-sending instrument

Another curio is a Morse-sending plate consisting of raised brass strips representing the symbols of the Morse code. An electrically connected stylus is drawn over the strips and the resulting electrical switching activates a signalling circuit.

This device was invented by Samuel Morse himself, in France in 1837, and can really be considered the very first hand-sending instrument, pre-dating Alfred Vail's hand-key by some six years. It was apparently tried on some European lines in the 1840s in the hope that less experienced operators could be employed but it had little success and the idea was abandoned.

Eighty years later, in the 1920s, the sending plate was re-invented by Graham and Latham Ltd of Chelsea. This was the 'Scribo-Morse' learning instrument, connected to a buzzer, and advertised in **Wireless World** with the claim that 'the learner's ear will rapidly become accustomed to the peculiar rhythm of each letter as he hears it'.

The idea surfaced yet again in WW2 when, according to Bill Eason G4MQN, writing in RAOTA's **OT News**, April 1989, Allied intelligence services made up instruments based on the same principle intended for agents who did not know Morse. One-way messages were sent in CW and replies were received later in the form of coded speech messages broadcast by the BBC.

Another version of this type of instrument can be seen at the Royal Signals Museum. This is the 'Squirt', so named because it was intended to send short messages at very high speed. John Brown G3EUR, designer of the B2 and other clandestine sets, was involved in the development work on this instrument although he tells me he has no specific information about its use in Europe.

My sending plate dates from the 1920s. I don't know if any of Professor Morse's original instruments are held by private collectors, but I believe examples made to send early Austro-Germanic Morse can be found in museums in Germany and Austria.

Surplus can still satisfy

When I recently worked Jim Toon as GM0FNH/M on 40m CW, I was intrigued to learn he was using an ex-army RT-316 Lightweight HF Patrol Radio, dating from the 1960s, which he bought about a year ago from an army surplus store.

He kindly sent me a copy of his User Handbook and I must say it has a lot to offer the enthusiastic QRPer. Operating on 12V dc, and putting out 4W, it has nine switched, crystal controlled, basic frequencies over the range 2-7MHz. Each basic frequency can be offset by a second switch to give five frequencies about 2.5kHz apart, making a total of forty-five working frequencies. For amateur use, of course, just three crystals, giving five frequencies each around the QRP frequencies in top band, 80m and 40m, would provide a good minimum coverage.

For reception there are alternative 300Hz or 6kHz bandwidths, the latter helping to overcome the difficulty experienced in transeiving with crystal control when the other station comes back slightly off-frequency or with poor frequency stability. These sets are hard to find, but could represent a low cost approach to QRPing for those not into home-construction.

The Morse Machine

I have been experimenting with my new AEA MM-3 Morse Machine and have been using its QSO simulator based on AEA's Dr QSO(tm) program for the Commodore 64.

It is absolutely fascinating to work simulated stations from across the United States and have them address me by name. Whether calling or answering a CQ or listening to two 'stations' working each other it is incredibly realistic (apart from the lack of QRM!) with some exchanges going well beyond the 'rubber stamp' format. If one makes a mistake the other station asks for a repeat. Likewise you can ask for a repeat of name, QTH or signal report, or ask 'him' to QRS or QRQ.

The speeds of the simulated stations can be set between a chosen upper level and a lower speed about two-thirds of maximum. Within these limits stations then come back at different speeds to test your abilities and help improve your own performance. The accuracy of your own sending can be checked by connecting the keyer's serial port to a computer and watching the text come up on the screen.

When conditions are poor it's a great temptation to use Dr QSO rather than go on the air! There's a great deal more to the Morse Machine than this of course, and I will report on some of its many other intriguing features later.

The World of DATA

BY DON FIELD G3XTT

Happy New Year. I hope Santa brought you that new TNC you wanted. Let's hope this year sees some worthwhile changes in the VHF packet network, such as mailbox access and forwarding on 70cm to reduce congestion. When we can start exchanging long program files in real-time with amateurs at the other end of the country we will know that we have cracked it!

Computer Networking Conference

Gateway, the US packet newsletter, recently carried news of the 1989 Computer Networking Conference sponsored by the ARRL and held in Colorado Springs. If there was a theme to the conference, reports Gateway, it was the need for improvements in the lower layers of the protocol stack. New or modified level 1 and 2 packet radio protocols were discussed in several papers, as were improvements to the radio systems in use.

A proposed broadcast protocol was presented by Gordon Beattie N2DSY. This protocol is implemented in the so-called BBC software package, which is part of the Radio Amateur Telecommunications Society (RATS) ROSE system. Improved performance of the AX25 link-layer protocol was proposed in papers by Lyle Johnson WA7GXD, Eric Gustafson N7CL and Detlef Schmidt DK4EG.

On the radio front, the fast-approaching advent of high-speed packet radio hardware generated discussion of the need for co-ordinated network efforts, culminating in a continental high-speed network. To whet the appetites of the packeteers present, Bdale Garbee N3EUA displayed the 10GHz, 1Mbit/s packet radio system developed with Glenn Elmore N6GN. HF wasn't neglected either, as the HF packet radio design quest announced by the ARRL earlier in the year begins to bear fruit.

At last year's Computer Networking Conference, Mike Chepponis K3MC presented a design for the 'Totally Awesome I/O card' (see World of Data, September 1989). Since then, the Awesome I/O Card, as it's known for short, has been under development at Digital

Radio Systems Inc (DRSI), in Clearwater, Florida. DRSI founder Andy DeMartini KC2FF brought copies of the Product News Brief, dated 7 October, to the 1989 Conference.

The improved Awesome I/O Card consists of an NEC V40 CPU running at 8MHz, two 1Mbit/s I/O ports with direct memory access (DMA), up to eight 19.2kbit/s ports and as much as 512 kbytes of dynamic RAM and 128 kbytes of EPROM. The card plugs into an IBM PC/XT/AT or acts as a stand-alone controller. Software will include an EPROM version of TCP/IP. Other packet radio networking providers are working on versions for the Awesome I/O card too.

The ARRL project

I mentioned above the ARRL initiative to promote technical innovation for HF packet radio. At a meeting on 8 October, the ARRL Digital Committee discussed the potential for vast improvement of HF packet. They defined four specific areas to improve: modem design, protocols, use of diversity techniques and network management. Each of these areas will be given ARRL support as needed by the issuance of grants to developers (not something we are likely to see the RSGB doing, unfortunately). It will be interesting to see what progress is made.

DCD modification

One innovation that is already having a beneficial effect on HF packet and, indeed, on VHF is a DCD (Data Carrier Detect) modification being made available by TAPR (The Tucson Amateur Packet Radio group). Proper operation of Data Carrier Detect (DCD) is imperative for efficient sharing of a packet channel. Many TNCs don't provide optimum DCD operation and the current version (2.0) of AX25 level 2 protocol compounds the problem. However, an inexpensive solution is now available to combat the former case and progress is being made in the latter case with the proposed changes to AX25 level 2 version 2.1.

The DCD modification, available for most of the popular TNCs, consists of a tiny printed circuit board which fits

inside the TNC and is plugged into the empty socket left after removing the existing DCD chip. For HF operation provision is made to connect a THRESHOLD control on to the demodulator. The result is a fast attack, slow decay DCD with a hang time to compensate for temporary fades due to multipath. When all stations sharing a channel have proper DCD action, data flows more efficiently.

For TNCs which are not direct TNC1 or TNC2 clones such as the KPC-1 and 2, KPC-2400, KAM, PK87, PK88, PK232, TNC-220 and TINY-2, the upgrade adaptor adds an EPROM-based state machine to derive DCD based on lock-up of a digital phase-lock loop. It is a PC board less than two inches square and mounts easily inside the cabinet of most TNCs. This upgrade is reported to improve DCD operation dramatically, even allowing you to run with your radio unswitched which reduces other stations' TXDELAY requirements, further improving throughput on the channel.

In **Connect International** GU3MBS reports ordering the DCD upgrade kit for his Tiny-2 direct from TAPR in the US and being able to get it going very easily. Your dealer may well be able to help with the mod or you can write direct to TAPR, PO Box 12925, Tucson, AZ 85732, USA for a list of kits and software.

HF diversity tests

One of the techniques that shows great promise for improved HF packet radio performance is diversity reception. Used for years by military and commercial stations, diversity is the technique of receiving the same signal on two different antennas. The antennas may be separated in space, different in polarisation or use different angles of arrival for the received signal.

Steve Hall WM6P has been testing some of these techniques and reported encouraging results at the eighth Computer Networking Conference. He plans to organise a group to work in this area to find usable approaches for HF packet radio. It will be interesting to see what the results are.

What intrigues me is that these research efforts are prompted by diffi-

RSGB Packet Working Group Guidelines on Packet Bulletins

Before sending us a bulletin, please ensure that it is appropriate to do so by checking the following points:

- 1) Is it abusive, libellous or defamatory? Is it racist or does it infringe someone's copyright? Apart from the personal trouble this kind of thing can bring, all it does is bring amateur radio into disrepute.
- 2) Does it constitute an advertisement? Any message which involves pecuniary interest (ie money), whether directly or indirectly, is illegal under the terms of our licence. It is *not* good enough just to omit any mention of money, nor to advertise for 'a good home' for your goods.
- 3) Could it be interpreted as being for the purpose of business, advertisement or propaganda purposes? This includes news or messages of, or on behalf of, any social, political, religious or commercial organisation. (Our licence specifically excepts from these prohibitions news of activities of non-profit organisations such as radio clubs.)
- 4) Will it serve a useful purpose? The amateur packet network is not a soapbox for the airing of grievances, broadcast of destructive commentary or conduct of personal vendettas. To do so is pointless. It just brings packet radio into disrepute and may land you on the wrong side of the law! If you have strong feelings on packet related topics which are likely to be of wider interest, write to one of the journals or contact the Packet Working Group.
- 5) Does it need to be a FLOOD bulletin at all? What's the point of telling the whole world (often literally) about your neighbour's lost cat, the M3 washers you need etc? If you need help try asking on your home BBS first. Use local distribution addresses before resorting to a '@ GBR'.
- 6) Don't send 'open letters' to individuals.
- 7) Don't write in the heat of the moment. Word process your bulletins first, then reread them before sending. You might find you feel differently after a few minutes!

Much of the above applies equally to non-bulletin traffic.

Please remember that in some of the more serious cases it's not just your own licence which may be at stake – your mailbox sysop's licence also places upon him obligations regarding the content of messages transmitted by his station – you may also land others in the kind of trouble that everyone wishes to avoid.

Golden rule: If you wouldn't say it on phone, don't send it on packet!

culties with using packet radio on the HF bands. AMTOR, as I have discussed before, is in many ways a preferable mode for data transmission on HF. Packet may well overtake it as the technology adapts, but I can't help feeling that if the same level of R&D were put into AMTOR it would remain streets ahead of packet. The reason this doesn't happen is that AMTOR was first introduced in the UK and Europe and has never really caught on in the USA, the old 'not invented here' syndrome.

Earthquake

Packet radio came into its own in the aftermath of the California earthquake, allowing health and welfare traffic to be passed on behalf of public officials and the American Red Cross. The network was operational on both 2m and 220MHz in and around the San Francisco area. Packet radio is, of course, ideally suited for use in such situations.

RTTY repeater

The RSGB recently reported that the GB3PT RTTY repeater, located near Royston, has changed speed from 45.45 to 50 baud in accordance with RSGB recommendations. The repeater also supports V21 data at 300 baud. Input

frequency is 433.9MHz, and output is on 433.3MHz. The RTTY tones are Mark at 1445Hz and Space at 1275Hz. Data tones are 980(1) and 1180(0) In and 1650(1) and 1850(0) Out.

The BARTG news bulletin followed the RSGB report with information on how to use the repeater. Key your transmitter, modulated with a Mark tone. The repeater should reply with a carrier and 1kHz tone, which will cease after the user types 'GB3PT'. Data mode is accessed in a similar manner – the repeater recognises the mode required by the data tones which it receives.

Discipline on packet

The uses and abuses of mailbox flood bulletins are a continuing cause of widespread concern and the RSGB Packet Working Group has compiled a set of guidelines which it urges users to follow. My own view is that this is crucial if packet is to survive and prosper.

At the moment the packet network seems to have become a national soap box for those who have an axe to grind, a state of affairs which is likely to drive away the serious experimenters who can help to improve the network and facilities it offers. I would recommend all World of Data readers to adopt the PWG

guidelines and to encourage others to do the same. The guidelines, issued by G8KHV on behalf of the RSGB Packet Working Group, are reproduced here.

Operating news

The September issue of **QST** magazine carried the results of the first ARRL RTTY Round-up held in January. The listings included entries from a number of UK amateurs, notably G0ATX, G4SKA, G0ARF, GW0ANA, G4MKO and G14TSK.

G0ATX was the leading G entrant in the BARTG Spring HF Contest, taking seventeenth place overall out of 155 entries.

GU4YMV led the pack in the BARTG Spring VHF Contest, though activity overall was low. Packet radio seems to have killed RTTY on the VHF bands.

Both the Norwegian and US DXpeditions to Bouvet Island (see my DX Diary column) are planning RTTY activity, and a number of other interesting ones have shown up recently on the HF bands. Perhaps the most surprising has been BZ1FB from China, worked in the UK on both AMTOR and packet.

Don't forget the New Year RTTY event which takes place on 1 January on the HF bands. Exchange new year greetings in your native language with the other participants.

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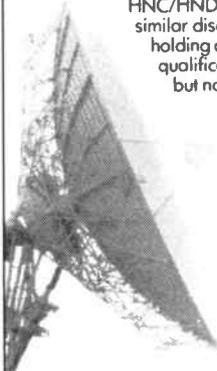
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SHORT WAVE LISTENER

TREVOR MORGAN GW40XB

Happy New Year to you all! 1989 came to an end with the European mainland in turmoil. We can only wait and see how the recent developments in eastern Europe will affect the amateur radio scene, but listeners in the Eastern bloc countries seem to be 'opening up' in their correspondence to me at any rate and are full of hope for the future.

Foreign languages

Of course, amateur radio has always been boundary free as far as possible, although the eastern chaps have sometimes been a bit 'short' in passing information. Much of this has been due to language problems, but that is true even with other countries. I have often experienced QSOs that have terminated with '... sorry, but my English not good... 73s old man'. The trouble is that most English speaking nations expect the other guys to speak our lingo and rarely attempt to learn another language.

Most of us, it seems, paid little attention to our language classes at school, preferring to spend the time tying knots in Sally's plaits or reading the **Beano** under the desk!

However, all is not lost. There are short courses in 'radio languages' which are suitable for both the listener and licensee. Once you have grasped the basics of conducting a QSO in a particular language, it's only a short step to learning that little bit more.

It's well-known among regular QSL card hunters that reports to broadcast stations in South America are far more likely to attract a card if the report is in Spanish or Portuguese, but even a simple 'Obrigado pelo seu interesse. Atenciosamente' ('Thanking you for your interest. Best wishes' - Portuguese) at the end of a report is likely to pay dividends.

Jonathan Marks of Radio

Nederland gives some good reporting information in **Guide to Broadcasting Stations**, by Philip Darrington, and published by Heineman Newnes. Radio Amateur Conversation Guides are available from the RSGB covering Dutch, French, Russian, German and Spanish, and many of the scripts used can be converted for listener reporting.

The Scouts

Another big 'boundary crosser' is the Scout organisation, which has members worldwide. Once a year the Scouts greet their fellows using amateur radio. This serves two purposes: it enables the Scouts, who are unable to meet at international jamborees, to exchange greetings and introduces amateur radio to many who have never experienced it.

I have received entries for the International Listeners Association JOTA Award, which is presented to listeners for logging Scout stations over the period.

Points are scored as two for each overseas station logged and one for each home station, plus ten bonus points are awarded for GB2COD, GB2GP and GB2WFF.

Band reports

The first report is from Clifford Tooke G1516, who stated that the bands on Saturday 21 October were not very good and that there was a lot of 'tuning-up' evident on those frequencies in use, causing a few 'heated exchanges'. Apparently, stations suffered a lot of structural damage because of high winds over the weekend.

Clifford's score is 167 points, with eighty-nine UK stations and thirty overseas stations logged. Well done!

The next report is from Stan Porter ORS 45992, who was logging from his new location in Santa Maria, Portugal, with a Sony ICF7600D and a 6m 'wet string'. Although he didn't get as much time in

as he would have usually, he enjoyed the session. Stan's score is fifty-eight points with four home stations, the rest were outside Portugal. No doubt you'll beat that score next time, Stan!

Next in line is Philip Davies ILA 023, who was using his old faithful Eddystone 840A. Phil was particularly fascinated by the number of UK Scout troops operating from small villages, and he had fun tracing them in his road atlas.

Phil's total score is 228 points, with fifty-one overseas stations logged. Good going, Phil!

The next report is from Paul Baylis of Vigo, Kent, who was busy logging for his entry between bouts at the mike as part of GB2VSD. Nevertheless Paul managed ninety-six points, including twelve overseas stations and sixty-three in the United Kingdom. Good effort, Paul!

Finally Hedley Falkinder ILA 150, sent in a massive entry. Commenting on the poor band conditions and early close-down by many Scout stations, he still managed a superb score of 430 points, including 132 overseas stations. Congratulations, Hedley! Another trophy to add to your collection!

Looking through the logs it seems that most of Europe was represented, with Holland being the most prominent as usual. Luxembourg was in there and Cyprus put on a show. The African states were also represented with Algeria, Lebanon, Nigeria and South Africa logged, including ZS1SEA and ZS1AIR. ZD7JAM in St Helena was found on 15m, while a lonely W4DRJ/J from Richmond, Virginia, was the only Statesider logged by anyone! Conditions must have been bad!

Contests

So to the general band reports, and for this we thank Philip Davies for his observations based on some of the major contest periods.

September (WAE SSB); 4X0WAE (Israel) and ZS1IS (Walvis Bay) were nice catches on 10m, while 15m yielded UA0ZDD (Obl.128 Kamchatka) and JH5RXS. 20m offered KH6KZ, EK4AA, NB6F and TM7EU (at the centre of the EEC in St Andre le Coq!). 40m found KT9M, WE9V, W7WA, VE7SZ, WA8SXM and K6IR.

The Scandinavian Contest during September revealed some interesting contacts including C11YX (Nova Scotia), 4D9HAM (to celebrate the sixth anniversary of the Mindinao Island ARS), LR2DW, OX1O (Greenland), 7S4BX (Sweden) and OF0AM (Finland).

The RSGB 21/28 Contest in October was one I took part in myself and, while Phil reports KD7P/NH2 (Guam), XF3RD (Mexico) and VU2SM (India) on 10m, I found 15m more productive with plenty of Japanese and Americans active as well as HL9HH (Korea), YC9VGB (Indonesia) and 3X1SG (Guinea), while 10m found KP1UGF (Nevassa Island).

Good contest, though, and even I managed to catch all the American states, all but one of the Canadians and a couple of dozen Japanese areas!

The CQWW SSB Contest found Italy going crazy with 19, IG8, IH9, II1, IM8, IO2, IP4, IQ4, IU3 and IU6... a headache for some, but good for prefix hunters. 10m found HC8K, HU1A, C53FW, CW8B, XL3XN, 4J5FV and ZF2HV. On 15m CF11DX, HQA, HV3SJ, OL8A and CN0A. 20m was very lively with BY1PK causing havoc with zone twenty-four, and JW1 and JW7 on Svalbard hooked them in like herrings. ZW5B, YY3A, AZ5D, L1Y and 5J6CQ kept the rest occupied. Even the lower bands got a look in with 40m showing NE9O, AD8C, NG8D, OL4A and OR5EEC for a special. Top band offered LX7A, GJ6UW, IQ4A, IU3A, OQ7LR and RQ7W.

There was some nice stuff to be found during the contest season, so the bands can't have been all that bad for listeners.

Outside the contests JT0DX (Mongolia), TT8GA (Chad), XT2PS (Volta), LH2A (University station, Norway), A61AC (UAE), AP2JZB (Pakistan) and VE6DOC (Alberta) were all nice ones to log.

A nice tale to finish with about Y1BX. This call was originally issued to UP2PBY in 1938 and he has now had it re-issued to him after all this time. His own words were 'Thanks be to God, I now have my old call again!'

Awards

Others have also been adding to long-time listings, such as Luciano Marquardt G1VDW, who claims 9V1NQ (Singapore), TT8GA (Chad), HC2G (Ecuador), V29OA (Antigua), VP9LR (Bermuda) and ZW5B. QSL returns include FH/DL7FT (Mayotte), VK2RK, ZS6MAR, A92BE and D44BS. Luciano is taking a rest in 9H (Malta) during February, but he will be back in the hunt soon.

Peter Bowles of Newhaven has been logging some new ones with TT8GA and JH1EVF (in QSO), as well as J28TY with LY1BYL and others on 10m, followed by K5MK/5 on 20m. The postman cheered him up no end when he delivered a QSL from ZD8PJ.

QSL information from Pete includes UO4OR via PO Box 174, Tiraspol, Moldavia 278000, USSR; 4N1K via YU1XA Blagomir Mitrasinovic, Sarajevska 4, 3100 Titovo Uzice, Yugoslavia; C13XN via VE3XN, QTHR; and J28TY via PO Box 2417, Djibouti.

Martyn Whyte of Edinburgh has threatened me with his claim for the Premier Award (2,000 prefixes). While checking his logs he has managed to find EK2RR, CY0DXX, 9K3C, J73JM/KP2, 9V1UJ, A41JR, 8J1RL, C31SD, 3A/HB9DCQ, C6ADC, ED5TIA, JY8RK and CN8ST - to name just a few. However, he has not found the bands up to par lately.

Nathan Rosen of New Jersey, USA, has sent in another claim. His original claim was mislaid in the post, but a replacement kept him happy so now he's claiming

the Continental Award for USSR (100 stations), and all verified by QSL too! IRCs are not so easy to get over in his neck of the woods, but I'm sure I will find a use for the greenbacks some day.

High winds

Recent high winds, especially over the late October/early November period, put many aerial set-ups in danger... mine included. I am normally a 'belt and braces' chap but I must have left a guy slightly slack at some time, with disastrous results over the 'Leicester' weekend. On my return home, my son informed me that my 35ft mast was horizontal and that a couple of aerials had been badly damaged. The following is his account of what happened.

At about 1430hrs, there was a sudden rise in wind-speed to well over 60mph. Where I live, this speed is amplified due to a 'tunnelling' effect caused by the local terrain and we often experience whirlwinds. However, the mast heeled to one side and one of the six guys slipped its mooring and, with the next sustained gust, the mast began to lean slightly. My son dashed into the garden to grab the loose guy but was seconds too late and could only guide the mast as it fell. There was a loud 'crack' and the lower section of 2in alloy buckled and collapsed.

The resulting damage to my vertical meant that I required a new top section, and my minibeam was virtually a write-off with most of the spokes missing and badly damaged traps.

The moral is you can't trust mother nature, so always check your guys regularly!

Well, that's it for this month. Keep sending in those reports and have a successful month DXing.

Reports should be sent to Trevor Morgan at 1 Jersey Street, Hafod, Swansea SA1 2HF, Wales.

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News and comment from Glen Ross G8MWR

New UK record

In last month's edition I gave news of several new world records that have been set Stateside recently. Not to be outdone, I can now report a new UK record which has been set on the 24GHz band and which is reported in the current edition of the Microwave Newsletter. It still does not beat the long-standing narrowband record which was set several years ago by G3BNL and G3AAZ, but it has long been the ambition of many people to set a new record using wideband FM. The previous distance record was 127km and was held jointly by G3FNQ and G3NKL; notice that all the old record holders were G3 licence holders. The new record of 135km is held by G8AGN and G3PYB, so the class B men have broken in at last.

More details

The record was set on 15 October at around 0900hrs GMT. G8AGN was located at Beeley Moor, which is near Chesterfield (SK303681), and G3PYB was at Blakey Ridge on the West Yorkshire Moors (SE685979). The equipment used at both ends was based around the ubiquitous Plessey GDHM32 in-line units with a nominal transmit power of 7mW. A 45cm diameter dish was used by G8AGN, whilst G3PYB used a 60cm unit.

Weather conditions at the time included low temperatures and some ground frost with a very low water content. This last point is very important because water vapour absorbs a tremendous amount of the radiated power at these frequencies.

Our congratulations to both stations on getting the result they were trying for after so many near misses in the past.

Beacons

A message from Iain G4SNL asks for some publicity for his new 10GHz wideband FM beacon. This is located at Saltash in Cornwall, at locator IO70VJ. The power output at the time of writing is 10mW and the aerial beams roughly north

towards Caradon Hill. At the moment Iain is using a small horn aerial, but he intends to fit an omnidirectional Alford Slot in the near future. The beacon is one of the new 'attended' type and if you want to make sure it is running properly when you need it, then contact Iain. Tel: (0742) 849601, or you can get him on packet via GB7PLY.

As one comes on another door hits you in the face! The RSGB have reported the failure of the Ipswich 10GHz beacon GB3MHX. This is apparently due to a damaged feeder cable, so the beacon will be off the air for some time until it is replaced.

Reciprocity

It is not often one gets a chance to use that word in an article, so why has it crept in here? Well, when used in connection with aerials it describes a property which many people seem to have forgotten about. That is that, with some exceptions such as small ferrite bars on the HF bands, an aerial provides the same gain on transmit as it does on receive. Just recently, I have heard several people passing remarks on the lines of 'He is running 50W to a twelve-element beam and I have only 50W to a two-element beam, and yet we are sending each other identical reports.'

No surprise

Let us work this one out. Assume that the twelve-element beam has a gain of 15dB and your two-element one can only manage 5dB. When the other station sends to you, his aerial gives 15dB and yours adds another 5dB, giving a total of 20dB gain. When you send to him your aerial gives 5dB and his large beam adds 15dB, and so you still end up with a total of 20dB gain on the path. Therefore, the signal levels are identical in both directions. Even if the transmitted power levels are different, the total aerial gain used on the path is always the same. It is the total gain of *both* the aerials being used; thanks to reciprocity.

The Mole

G4AFJ is the chairman of the RSGB Repeater Management Group (note the use of the word 'Management' in the title) and he is renowned for being a difficult person to get a letter from. He admits this and in a recent letter to one of our correspondents he starts by heading it 'A reply at last'.

He goes on to say, in answer to complaints about lack of interest in repeater management, that they will not be closed down because 'The repeater has done nothing wrong. It works perfectly well relaying on its output whatever is fed into it on the input. If we close the repeater down it is equivalent to saying that because people get killed on the M1 it should be closed down for four weeks every time someone gets killed on it.'

You might, perhaps, wonder how someone who has this sort of attitude to repeater management plus a reputation for not even responding to correspondence was ever selected as the right person to hold down the job.

Results

Now we come to an even more interesting bit. As we all know the lady is not for turning, but apparently if you lean on him heavily enough G4AFJ will oblige with a subtle about-face. After many representations to the RSGB, who are the licence holders for all repeaters, followed by a deputation to the RSGB council meeting, the Society have at long last given in to public pressure and closed down the GB3NA repeater. This has been reported as being done to allow consultation, while the worst offenders are no longer on the airwaves.

I have received some letters on the subject which say, in effect, 'What is the point of closing down a repeater? The troublemakers will only go elsewhere.' The other line of attack is to ask why a large majority of people should suffer the loss of the repeater simply so that the offenders can be silenced.

Responses

The answer to the second question is probably to ask what is the point of having the use of a repeater which is unusable because of the antics of these idiots. Perhaps the answer to the first point is that if you move wrong-doers they'll always go somewhere else, but at least you are trying to do something about the situation, rather than just accepting it.

The real answer is simply never respond to an idiot, they can only get any fun out of it if they see that you are getting worked up about the situation. There is little point in these idiots trying to make a nuisance of themselves if the only thing they are annoying is thin air. When it comes to personal abuse we are into more serious things and an official complaint and response are probably the only answers. You may complain fast enough, but whether you are going to receive an official response is a matter of conjecture.

DTMF codes

Following on from this is the idea of closing down a repeater remotely. This is technically easy to do, usually via a microwave link, as is fairly common in the United States.

There is a simpler method available and that is to have control over the repeater by sending combinations of the tones which can be generated using the standard DTMF coding keys – now available on even the simplest of hand-helds. The idea is that by sending suitable combinations of codes you could, for example, reduce the receiver sensitivity, switch the repeater off for a predetermined length of time, or perform many other control functions.

Problems

The major snag with this type of control is that it would not take long for an enthusiastic idiot to discover what the various control code sequences were. Having done this the idiot could then have a great time controlling the repeater himself; not exactly a desirable state of affairs in anyone's language. To get over this particular problem the suggestion is to use sub-audible tone codes. These frequencies are below the normal range of human hearing and, again, are available on many rigs as sub-audible squelching tones.

Recording

On the face of it, this seems a much

safer way of doing things but, in fact, it's still easy to discover the code if you are sufficiently determined. The answer is to simply tape-record the control codes and then replay them at a faster speed. This makes the tones audible, and the frequencies can then be measured. You now simply divide the measured tone frequencies using the same factor by which the tape was speeded up, and you have the sub-audible control frequencies that you are trying to discover. Once again, the idiot is in control.

In practice

It must be admitted that the second system takes a lot more effort to crack than the first, and it is fairly certain that few people would go to the bother of trying to crack the codes. Unfortunately there are always people who love a challenge (think of computer hackers) and it needs only a couple of people in the repeater's coverage area to crack the code and you are in trouble again.

It must be obvious that some form of control is desirable; the biggest problem of all is in trying to get the DTI to agree to it. At the moment they do not seem to go along with any control method, other than someone visiting the repeater site and physically switching it off.

50MHz news

Just enough space for a quick run down on stations worked by UK, F, ON and PA stations.

26 October saw early evening openings to South Africa, mainly KG square.

Around 1030hrs on 27 October there was a rather weak opening into Japan, but there are no reports of contacts being made. By 1045hrs the opening had moved around to Western Australia, and several VK6 stations are reported to have been worked. By 1230hrs it was the turn of Nigeria to get in on the act.

On 28 October, from 0930 to 1030hrs, there was an opening into Japan, with JAGIEF and JA4MBM providing good signals.

Widespread

29 October provided signals from VK8, from 0940 to 1015hrs; G3KLF/mm was worked at 1033hrs from near Muscat. From 1025 to 1045hrs, an opening occurred to Japan. From 1150 to 1430hrs the band was open to South Africa. These conditions continued to 5 November when there was an excellent opening into the USA and Canada.

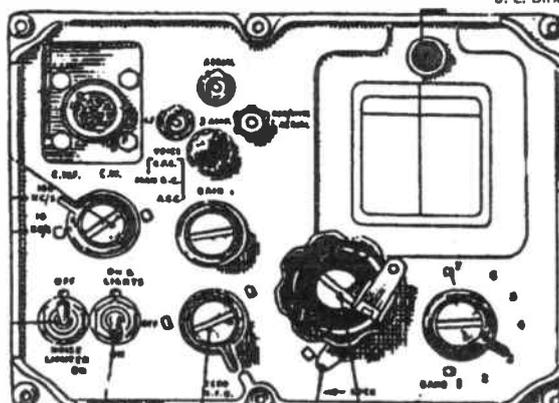
Thursday 9 November produced a small aurora opening. There was also an excellent opening to the USA and this was followed on the 10th with a superb opening into South America. During this opening there were some superb contacts with ZC4MK in Cyprus.

Close-down

That's it for this month. You can contact me at 81 Ringwood Highway, Coventry, or via packet at GB7NUN.

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ONE CHIP BURGLAR ALARM

by John Tweaker

Burglar alarm designs are commonplace, but this is one of the smallest full feature circuits yet. It provides variable EXIT and ENTRY delays and a time-out shut-down (once the alarm has been triggered it is automatically silenced after a preset period has elapsed). Although this article describes installing the circuit in a car it can also be used to protect any enclosed area, such as a garden shed or a drinks cabinet.

I have fitted this prototype to my own car and, despite its small size, it works just like 'the real thing' and has not proved susceptible to false alarms. In fact, I added a car horn to the circuit and wired it in parallel to the main one, except that the new addition is fitted under the driver's seat! This should make any car thief abandon his attempt.

The alarm is enabled by applying power to the circuit; you then have a short time to leave the car before the circuit becomes active (the EXIT DELAY). An optional LED can be fitted to

remind you that the burglar alarm is on.

When you return to the car, you simply open the door and get in. Although the alarm will be triggered it will not start immediately. You now have a short time to disable the alarm before it sets the car hooter off (the ENTRY DELAY). If a burglar opens the door, the alarm will soon start and hopefully frighten him away. After a preset time the alarm stops (the TIME-OUT period), preventing the alarm from draining the battery.

Circuit description

The alarm circuit consists of two wired loops to detect entry into the car (see Fig 1). These are the Normally Open loop (NO) and Normally Closed loop (NC). They usually consist of switch contacts fitted to the doors of the car, such as the courtesy light switches. You can also include extra switches if desired, eg, a wire loop passing through the case of the car radio as part of the NC circuit, or a spare contact on the ignition switch as

part of the NO circuit. The alarm is enabled or disabled simply by applying or removing the power supply to it.

The circuit is built around a CMOS quad NOR gate IC. The four gates N1 to N4 are used as gated monostables. Resistors R1 and R2 bias pin 1 of N1 to a logic '1' state when the NC and NO switches are in their normal position. C1 and VR1 provide the EXIT DELAY. Power is applied when C1 charges via VR1, causing the junction of R3 and VR1 to be initially a logic '1' at switch on and then slowly change to a logic '0'. Afterwards the latch formed by N1, N2 and D1 is enabled.

Capacitor C2 and the variable resistor VR2 provide the entry delay. The latch is set by operating any of the NC or NO switches; the output of N1 at pin 3 goes to logic '1' and C2 charges via VR2. This causes the level at pin 8 of N4 to slowly change from a '0' to '1', giving the ENTRY DELAY.

If the alarm is not disabled after the

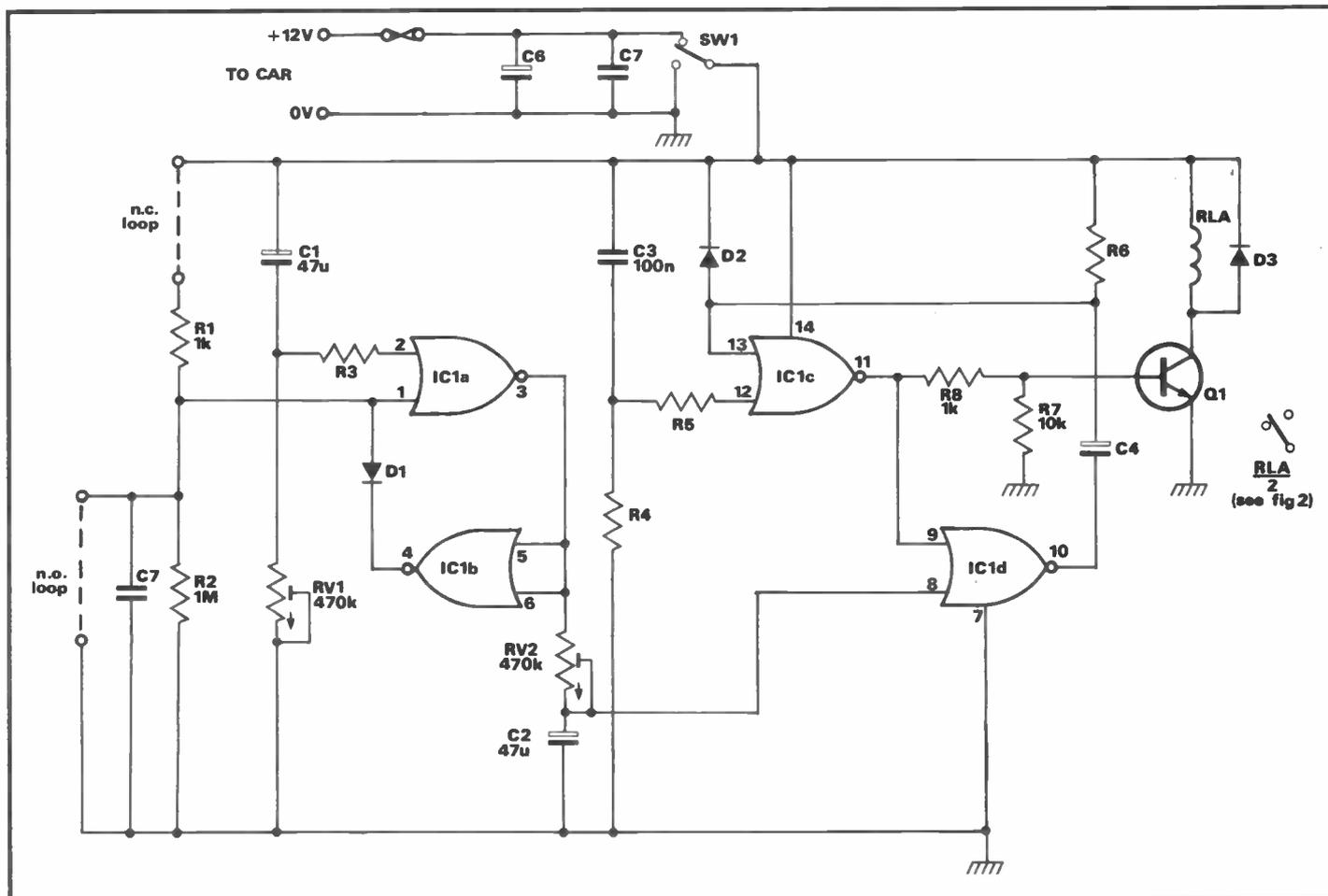


Fig 1: The alarm circuit layout

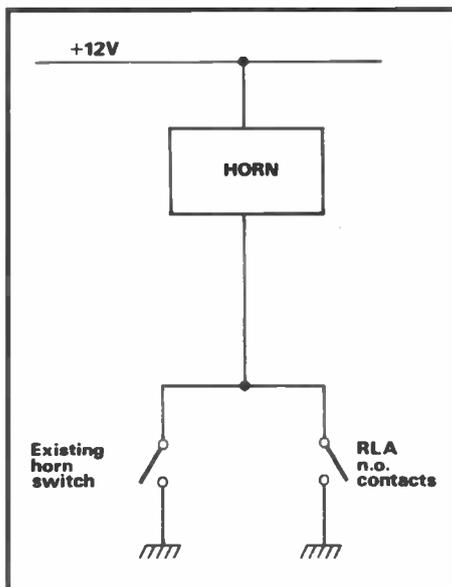


Fig 2a: Connecting the horn to the alarm circuit

ENTRY DELAY expires the monostable formed by N3, N4, C3 and R6 is triggered. This monostable drives the relay via R7 and TR1, and the relay contacts are used to sound the car hooter. D2 provides a discharge path for C3 after the circuit is disabled.

The period of the monostable gives the TIME-OUT delay, after which the relay is de-energised and the hooter silenced. The TIME-OUT facility can be dispensed with by replacing C3 with a wire link, which turns the monostable into a latch and allows the hooter to sound until the alarm is disabled (or the battery runs flat!). This is not recommended for car applications of the alarm, but it is useful in the drinks cabinet version!

Figs 2a-c shows how to fit the alarm to a negatively earthed car. If the circuit is used for any other purpose, a power supply will be required. If a low power Piezoelectric buzzer is used, the relay can be dispensed with and a 9V

PP3 battery can be used instead. Note that the delay obtained will be affected by the actual power supply voltage used.

Setting up

With the component values specified, you should obtain the following delays (setting VR1 and VR2 fully clockwise gives the maximum EXIT and ENTRY DELAYS):

EXIT DELAY is variable from eleven to fifteen seconds; ENTRY DELAY is variable from thirteen to nineteen seconds; and TIME-OUT DELAY lasts for four minutes approximately.

Construction and use

The prototype was made on Veroboard and mounted in a small die-cast box with a connector block attached to the lid of the box.

All the capacitors are low leakage current types since small leakage currents upset the operation of the monostables, especially C3 which should be of a new high-quality type. Don't use tantalum dielectric types, except for supply rail smoothing. A fixed value of resistance, rather than a potentiometer is preferred for R6.

Obviously it is necessary to conceal the box which contains the circuit, since any would-be thief will try to disable it if it's in view.

The most likely place to fit the box is underneath the dashboard. Once the box has been attached, position the ENABLE/DISABLE switch so it can be reached easily and inconspicuously. It's best to locate it within arm's reach so that you can switch it off quickly, allowing short entry delays to be used.

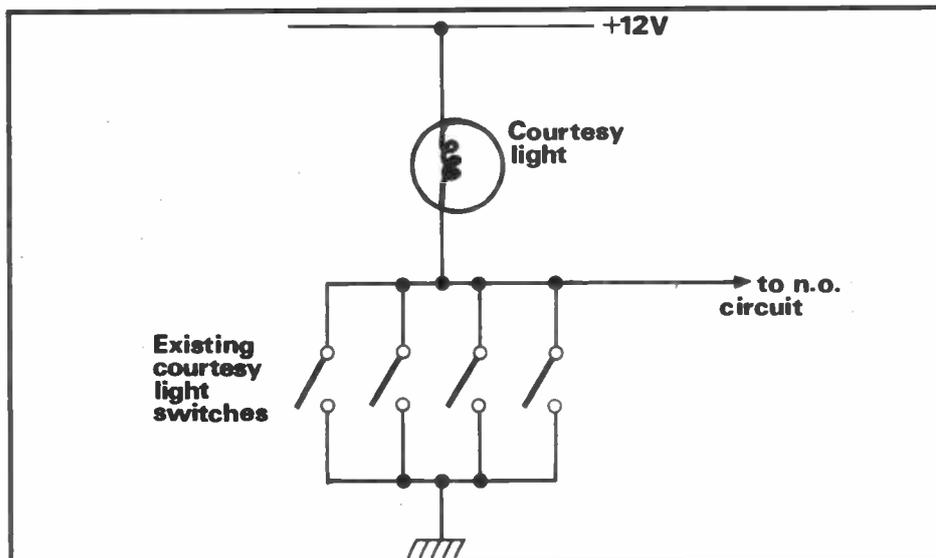


Fig 2b: Detecting the opening of the car door by using the existing courtesy light circuit

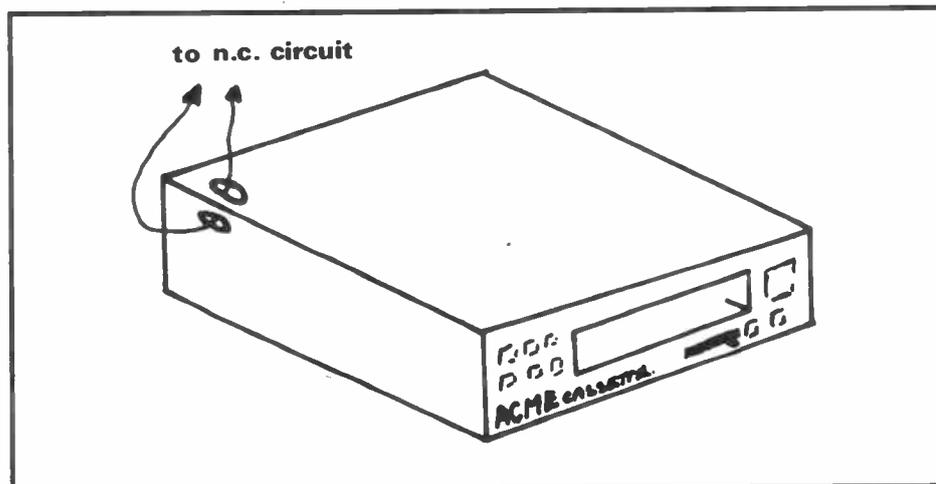


Fig 2c: Protecting a radio by drilling two small holes and passing insulating wire through them

Parts List

All resistors 1/4W	
R1,8	1ko
R2,6	1mo
R3,5	15k
R4	100k
R7	10k
VR1,2	470k
C1,2,6	47µF 25V not tantalum
C4	100µF 25V not tantalum
D1	1N414B
D2,3	1N4001
IC1	4001
Q1	BFY51
RLA	12V coil SPCO (eg,RS 344-467)
SW1	SPCO toggle-switch
F1	1A fuse in holder

Die-cast box, connection block, nuts and bolts etc.

PROJECT BOOK

by Martin Williams

First of all this month, let's clear up some of the recent confusion about voltage boosting by using transformer input taps other than the standard 240V. My article in the November issue offered this method as a means of getting a few more volts but, whilst I thought it was reasonably clear, I have had several letters asking for clarification.

Boosting

To keep the maths easy let's assume the standard mains voltage of 240V and that the secondary winding of the transformer will provide 12V at the rated load current.

What happens if the mains is connected to the 220V input tap on the transformer instead of the 240V one? We are now feeding 240V into the 220V tap, which amounts to an increase of nearly ten per cent. So, the secondary voltage rises by the same percentage and now provides 13.25V. If the mains were taken to the 200V input the increase would be twenty per cent and the secondary voltage would rise to about 14.5V. The 2.5V gain could make all the difference between the following regulator circuit working well or not at all.

Capacitors

Having sorted out the transformer and rectifier system, you now need to think about the reservoir capacitor. This is, in effect, the battery from which all the gear is operated. You can look upon the mains side of the circuit as an instant charger which keeps the battery fully charged. The reservoir capacitor is usually chosen on the basis of fitting the largest value you can get your hands on and hoping for the best. As you may have suspected by now, there is rather more to it than that.

Minimum values

There is a minimum value required for this capacitor if it is to carry out its job properly. What you have to do is resist

the temptation to use a significantly higher value. This is because when you first switch on, the reservoir capacitor looks like a near short circuit, and the higher the value of the capacitor the closer it resembles a dead short.

When you first switch on the power supply, there is a tremendous rush of current into the electrolytic capacitor. This causes a heavy mains input current to flow, resulting in blown fuses. The temptation is to fit larger capacity fuses but this is a dangerous practice, since they are far too heavily rated to protect the PSU at normal running mains currents.

Calculations

It is possible to work out mathematically the size of an appropriate reservoir capacitor, but it is probably easier to use a 'rule of thumb' method. This states that in the usual electronically stabilised power supply, you should use about 2,000 μ F for every 1A of current capability. For a 10A supply a capacitor of 22,000 μ F would be about right. If you use anything much less than this, then the voltage across the capacitor will sag to less than the minimum required to operate the voltage regulator circuitry correctly during the non-conductive part of the rectifier cycle. If this happens a ripple voltage will appear on the output circuitry, and you will have a hum problem.

Ripples

Remember that as part of the rectifying process there are two currents flowing in the circuit. One is the amount of dc current you are using to operate externally connected equipment. The other is a hidden ac current passing through the rectifiers and the reservoir capacitor. It is essential that the reservoir capacitor can handle this current safely. The ripple current flowing in the circuit is normally at least equal to the

total dc current capability of the power supply. Sometimes the ripple rating is marked on the component but if it is not, then select a capacitor with heavy-duty screw connectors. These are used to enable the capacitor to handle very high currents. Another good choice is a unit with fluted areas in the case.

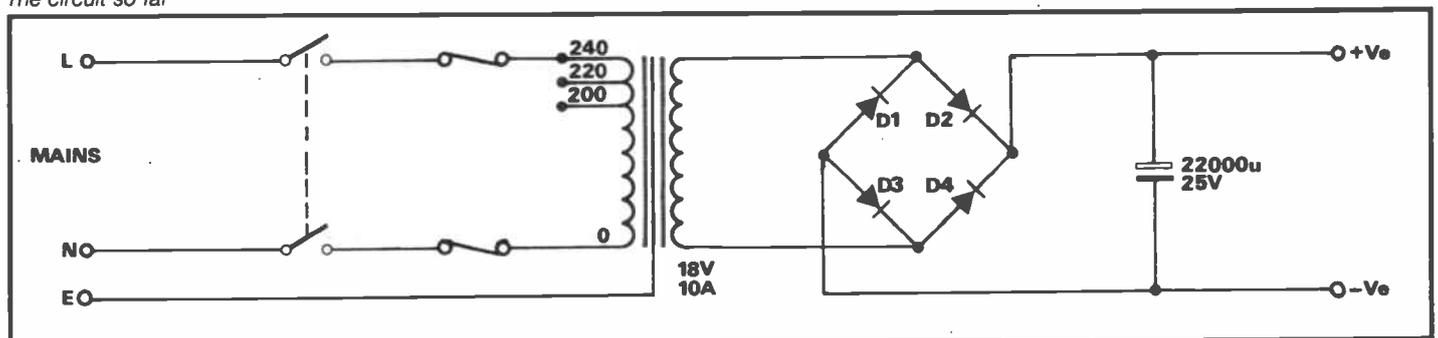
Wiring

The size of the terminals fitted to the capacitor should also give you a hint as to the type of wire to use for connections in the PSU. It is obvious that all the dc leads should be in a gauge of wire which will handle the maximum current. Then use thin hook-up wire to connect to the reservoir capacitor. Remember the ripple current and use wire of at least as heavy a gauge as that used in the dc lines.

Coming soon

Next month we move on to heatsinking. Yes, there is more to it than just fitting a large chunk of metal on the back of the power supply case! I will also get involved in various voltage regulation systems. Stay with us and become a power supply guru.

The circuit so far



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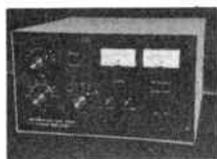
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DEADLINE AND CONDITIONS

Advertisements will be published in the first available issue on a first come first served basis. We reserve the right to edit or exclude any ad. Trade advertisements are not accepted.

FOR SALE

■ Yaesu FRG7, good condition, £140.00. Tel: (0272) 685210
■ BNOS power supply, 12/40A, £150.00. Black Star frequency counter, 5Hz-600MHz, £50.00. Welz SWR and power meter, SP300, 1.8-500MHz, 1000W, J Sensons, £50.00. 1000W dry dummy load, £25.00. Trio MC60A base mic, £30.00. Tel: (0689) 58825, or (0836) 679393, ask for Rodney
■ Sony 2001 World Radio, FM/AM SS/CW coverage (SW 150-29995kHz continuous coverage), excellent condition, £95.00. Amstrad PCW 8256 computer with printer, in original box, not used, £280.00. Tel: (0245) 322082 eve/weekends
■ Trio R2000 Rx, good condition, all leads and switches, plus Jaybeam TB1 and 2m Tonna antenna, both with cable, £400.00 no offers. Write to: W Abbey, 21 Moat Close, Bramley, Nr Basingstoke, Hants RG26 5AD
■ Panasonic radio RF-9000, FM/LW/MW/SW, phase-locked loop synthesiser, as new, originally cost over £1,000, offers? Tel: (0436) 74532
■ For NRD525: 1.8kHz CFL 218A crystal filter, excellent steep-sided response, £70.00. NRD ST3 communications headphones, made for professional marine use, £45.00. Icom CC5 world clock, £25.00. Active antenna for HF-225, £12.00. All boxed, as new, carriage extra. Tel: 01-570 5603 evenings
■ Jaybeam five-element folded dipole Yagi 2m boom, length 1.6m, good condition, £15.00 ovno. 2m linear amp, 10W in, 50W out, from Micro Mod, with preamp, mint condition, £55.00 ovno. Antenna rotator 200XL, plus control box, 220kg torque, vertical load 45kg, with three-core cable, mint condition, £30.00 ovno. Mark. Tel: 01-571 1609
■ National Panasonic CCTV system, with monitor and three cameras, all new, unused, sensible offers considered, cash or swap for WARC band linear amp and/or other ham gear. Tel: (0295) 253407 between 8.00pm and 9.00pm
■ Kenwood TS-680S, HF 6m, complete with Adonis 5039 comp mic, only six months old, £700.00. SP430, RN 6m, 25W amp, £40.00. RN 6m preamp, £15.00. SEM 6m Tranzmatch, £15.00. Skyking rotator, £15.00. Three-element 6m met Yagi, £20.00. SEM 2m preamp, £5.00. Twelve-element ZL 2m beam, £5.00. Will split or £880.00 the lot. Tel: (0483) 233991
■ Components clearout: selling all surplus shack components, chassis, equipment etc. Parcels of 10lb weight minimum containing hundreds of goodies, including loads of new, unused stuff, as well as good reusable ex-equipment items. Price for each parcel, only £3.50 plus £3.50 postage for one parcel, £4.50 postage for two or more. Twelve parcels available. Send cheque/postal order to: Mr Bailey, 'The Cottages', 96 Northfield Road, Harborne, Birmingham 17
■ Philips D2935 portable radio, AM/SSB/CW, 146 to 30MHz, continuous, PLL oscillator, LCD digital display, nine memories, keypad, telescopic and ferrite rod antennas, mains or battery, as new, £100.00. Tel: 01-455 8831
■ Harvad CB404, converted to 10m FM, £35.00. Yaesu circuits book, £8.00. Valve data book, £6.00. CT160 data book, £10.00. Write to: S Austin, 8 Greenwood Avenue, Chinnor, Oxon OX9 4HN
■ Amstrad radio/cassette, model 7090, £30.00. Wein AM/FM 670 radio, £25.00. Grundig Stenorette recorder, 2010, £15.00. Electronic keyer, ETM5C, £40.00. Yaesu mic, UD844, 50KΩ dynamic, £5.00. GDO Eddystone 370kHz to 115MHz, £20.00. Hamgear preselector PM11F, 1.5 to 34MHz, £12.00. Sentinel low noise 2m preamp, £10.00. SST T1 random wire ATU, £15.00. SST T3 mobile antenna impedance t/former, £10.00. Tel: 01-650 2938
■ Black and white 12in video monitor, RCA type TC1112X, modified for switchable scan size and line scan reverse, complete video input, suit CCTV or security use, £60.00. Tel: 061-793 4936

■ Trio TR-751E, 144MHz all mode transceiver, eighteen months old, two aerials, £500.00. Tel: (0326) 73067
■ FT-290R with mutek board fitted, plus mobile mount, Ni-Cads, charger and case, boxed, also with rubber duck and 5/8 telescopic whip, good condition, £270.00. TR-2300 2m FM transceiver, complete with Ni-Cads, charger and case, boxed, £95.00. Tel: (0462) 435248
■ AOR 2002 scanner, VHF/UHF monitor, current model, 25-1300MHz AM/FM, mint condition, original box, £350.00. Tel: (0332) 675816
■ Reftec 934MHz sets, pair, gwo, complete with mics and manual. Exchange for KW107 ATU or sell, £80.00. Also Spectrum Plus Two, manual, PSU, boxed, thirty games. Swap for Sony ICF7600. Will swap all above for FV101 DM digital VFO. Write to: Ian Duffin, 5 Sunset Walk, Bush Estate, Eccles-on-Sea, Norfolk NR12 0SX.
■ Trio TR2500 hand-held 2m Tx, mint condition, with SMC25 speaker, mic and DC25 dc/dc converter, SCB leather case, Ni-Cad charger, mint condition and original packing, £180.00. Will swap for 2m mobile set plus mounting bracket and mic. Write to: Andy G0JIA, 27 Neville Drive, Irlam, Manchester M30 6JD
■ Stag 357 CB, 26.965-28.305MHz, USB/LSB/AM, needs FM module for UK CB 27/81, new mic, £50.00. Zetagi B150 linear, AM/FM/SSB, 12V, 75W FM, 100W SSB, £30.00. Grandstand Bluebird, forty channels, 27/81 CB, LED display, £25.00. Leson DT251 desk mic, tone, volume, speech processor ADJ, battery test/output meter, £20.00. Tel: (0920) 461860 after 6.00pm
■ Trio R600 general-coverage communications receiver, 0MHz-30MHz, AM (narrow and wide), USB/LSB/CW, good condition, with manual, an ideal starter into amateur radio. Sensible offers please. Tel: (0837) 54683 after 6.00pm
■ Racial RA1217 receiver, good condition and working order, with 200, 500, 1200, 3000 and 8000Hz filters, complete with maintenance, user and replacements manuals, solid-state, 240V mechanical digital VFO, 19in rack, 3 1/2in high, 1MHz to 30MHz, £170.00. Tel: (0524) 36813
■ R107 Rx, 1.2-17MHz, £65.00. TBS-7 Tx, 60-80MHz, £40.00. APN-1 altimeter, £40.00. Nineteen-set complete station, £115.00. Command Tx T20/ARC5, 4-5.3MHz, £45.00. HRO plus five coils, £40.00. Xtal calibrator, No10, £17.00. 100-1000kHz xtal class-D equip, £5.00. All items vgc. Petrol generator 6V, 6A, new, in transit box, £50.00. Gyro unit type 8112, new, £20.00. Tel: 091-410 3706
■ Trio Kenwood R2000, hardly used, immaculate condition, close examination welcome, £425.00. Buyer collects. Tel: (0843) 45561
■ Eddystone EA12 receiver, good condition, original box with handbook, excellent for CW and SSB, £150.00. Tel: (0792) 390233
■ Eddystone 680X receiver, mint condition, complete, £130.00. Also Eddystone 940 receiver, mint condition, complete, £140.00. Tel: 021-705 7774
■ Realistic PRO2004 AM/FM scanning receiver, 300 memories, 25-520MHz and 720-1300MHz, continuous, no gaps, wide FM allows reception of TV sound and FM, radio covers almost all VHF and UHF services, £250.00. Tel: (0482) 855436
■ Two portable communication (aerial) towers. Extend to approximately 60ft, complete with trailers, offers? Tel: 01-446 7736
■ Yaesu FRG8800 receiver, FRT7700 ATU, FRV8800 converter, YH77 headphones, covers 150kHz-30MHz, + 118-174MHz, AM/FM, SSB, CW, all in excellent condition with manuals and boxes, delivery within 100 miles considered, £600.00 ono. Tel: (0621) 772418
■ Meon 6m transverter, 2m IF, 15W output, good working order, complete with BNOS 6m low pass filter, £70.00. 2m HB9CV antenna, £2.00. Tel: (0909) 565443 QTHR

■ Satellite receiver connections CX2460R, thirty-two channels, infra-red remote control, 10.9GHz-11.7GHz, suitable for all satellites, £80.00 ono. Write to: J Walker, 13 Walton Road, Aldridge, Nr Walsall, Staffs WS9 8HN
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■ Nine-element Tonna for 2m, six months old, only used for a short period, £22.00. Tel: (0926) 498388
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■ TS4305, SP430, SP430 and MC50 desk mic, all items recently serviced by Lowe Electronics, any inspection welcome, £880.00. Also Kenpro ICR400 RC rotator and controller, unused, £120.00. All my equipment is in mint condition and complete with boxes and packing. Tel: (0506) 880345
■ Siggens: Marconi TF801D 10-470MHz, excellent order, £50.00. Meguru AM, FM gen, 16kHz-65MHz plus another 65MHz-135MHz, with 10.7MHz and 470kHz IF switched range and IF sweep display unit. All three units, £100.00. Will split or exchange for Marconi TF2171 sync or TM9694 UHF sweeper plug in, or TF2213 XY unit, any condition. Tel: (0252) 26170
■ Akia Mk4 4000DS, sound on sound, mint condition, or will exchange for PA 10-20W, £60.00. Tel: 061-998 6674
■ Cobra 148, suitable for conversion to 10MHz. Tel: (0283) 221870
■ Solartron CD711S Two, dual team oscilloscope with manual and spare valves, needs attention, £15.00. Tel: (0279) 842841 after 7.00pm
■ 934 station: pair of Delta 1s (one with cellnet, M/H preamp and mobile preamp), includes six beams, two collinears and mobile antenna. Exchange for 1012D add ons, 9600, Belcom LS-102L, plus cash or HF WHY? Also, swap two Reftec 934s in good working order for KW107 ATU. Write to: Ian Duffin, 5 Sunset Walk, Bush Estate, Eccles-on-Sea, Norfolk NR12 0SX
■ Superstar 2000, SSB/CB, £100.00. Colt 1600 DX, SSB/CB/AM/FM/USB/LSB/CW, £80.00. Cobra 146GTL DX, AM/FM/USB/LSB/CW, £60.00. All ideal for conversion. Also, Zetagi B300P burner, £70.00. Tel: (0742) 478570
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■ Realistic PRO 2005 scanner/receiver, 25-520MHz, 760-1300MHz, 400 memories, AM WBEM, WFM, 240V, 12V, as new, £285.00. Write to: Gregg, 2 Park Road, Granborough, Nr Aylesbury, Bucks MK18 3NS
■ Trio TM-211E, 2m, 25W, mobile, £220.00. Yaesu FT-73R transceiver, £170.00. Matsui MR4099, 150-30MHz Rx, SSB, £80.00. All boxed. Tel: (0792) 467384
■ Icom IC-202S, 3W, USB/LSB, CW, portable, excellent condition, mic, manual, power lead, £110.00. **Radio Comm**, January 1979 to October 1982, **Wireless World**, February 1983 to February 1984, open to offers. Can deliver to Glasgow. Tel: 041-553 2141 (day), 041-221 4796 (evenings)
■ RAE course, as new, twenty textbooks and exam papers from Radio and Telecomm School, cost over £75.00. Tel: (0222) 487299

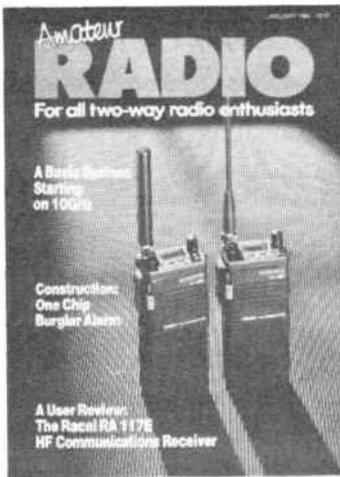
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issue	colour ad	mono proof ad	mono no proof & small ad	mono artwork	on sale thurs	
Feb 1990	20 Dec 89	18 Dec 89	3 Jan 90	5 Jan 90	25 Jan 90	
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<p>SERIES RATES Series rates also apply when larger or additional space to that initially booked is taken. An ad of at least the minimum space must appear in consecutive issues to qualify for series rates. Previous copy will automatically be repeated if no further copy is received. A 'hold ad' is acceptable for maintaining your series rate contract. This will automatically be inserted if no further copy is received. Display Ad and Small Ad series rate contracts are not interchangeable.</p>	<p>If series rate contract is cancelled, the advertiser will be liable to pay the unearned series discount already taken.</p> <p>COPY Except for County Guides copy may be changed monthly. No additional charges for typesetting or illustrations (except for colour separations). For illustrations just send photograph or artwork. Colour Ad rates do not include the cost of separations. Printed - web offset.</p>	<p>PAYMENT Above rates exclude VAT. All single insertion ads are accepted on a pre-payment basis only, unless an account is held. Accounts will be opened for series rate advertisers subject to satisfactory credit references. Accounts are strictly net and must be settled by the publication date. Overseas payments by International Money Order or credit card. FOR FURTHER INFORMATION CONTACT Amateur Radio, Sovereign House, Brentwood, Essex CM14 4SE (0277) 219876</p>	<p>Commission to approved advertising agencies is 10%.</p> <p>CONDITIONS 10% discount if advertising in both Amateur Radio and Radio & Electronics World. A voucher copy will be sent to Display and Colour advertisers only. Ads accepted subject to our standard conditions, available on request.</p>



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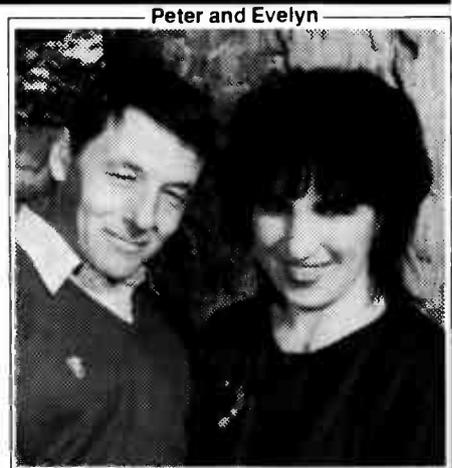
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- BD2 5 13A spurs provide a fused outlet to a ring main where devices such as a clock must not be switched off.
- BD7 4in flex switches with neon on/off lights, saves leaving things switched on.
- BD9 2 6V 1A mains transformers upright mounting with fixing clamps.
- BD11 1 6 1/2in speaker cabinet ideal for extensions, takes our speaker. Ref BD137.
- BD13 12 30 watt reed switches, it's surprising what you can make with these - burglar alarms, secret switches, relay, etc, etc.
- BD22 2 25 watt loudspeaker two unit crossovers.
- BD29 1 BOAC stereo unit is wonderful breakdown value.
- BD30 2 Nicad constant current chargers adapt to charge almost any nicad battery.
- BD32 2 Humidity switches, as the air becomes damper the membrane stretches and operates a microswitch.
- BD42 5 13A rocker switch three tags so on/off, or change over with centre off.
- BD45 1 24hr time switch, ex-Electricity Board, automatically adjust for lengthening and shortening day. Original cost £40 each.
- BD49 10 Neon valves, with series resistor, these make good night lights.
- BD56 1 Mini uniselector, one use is for an electric jigsaw puzzle, we give circuit diagram for this. One pulse into motor, moves switch through one pole.
- BD59 2 Flat solenoids - you could make your multi-tester read AC amps with this.
- BD67 1 Suck or blow operated pressure switch, or it can be operated by any low pressure variation such as water level in water tanks.
- BD103A 1 6V 750mA power supply, nicely cased with mains input and 6V output leads.
- BD120 2 Stripper boards, each contains a 400V 2A bridge rectifier and 14 other diodes and rectifiers as well as dozens of condensers, etc.
- BD128 10 Very fine drills for PCB boards etc. Normal cost about 80p each.
- BD132 2 Plastic boxes approx 3in cube with square hole through top, so ideal for interrupted beam switch.
- BD134 10 Motors for model aeroplanes, spin to start so needs no switch.
- BD139 6 Microphone inserts - magnetic 400 ohm also act as speakers.
- BD148 4 Reed relay kits, you get 16 reed switches and 4 coil sets with notes on making c/o relays and other gadgets.
- BD149 6 Safety cover for 13A sockets - prevent those inquisitive little fingers getting nasty shocks.
- BD180 6 Neon indicators in panel mounting holders with lens.
- BD193 6 5 amp 3 pin flush mounting sockets make a low cost disco panel.
- BD196 1 1in flex simmerstat - keeps your soldering iron etc, always at the ready.
- BD199 1 Mains solenoid, very powerful, has 1in pull or could push if modified.
- BD201 8 Keyboard switches - made for computers but have many other applications.
- BD211 1 Electric clock, mains operated, put this in a box and you need never be late.
- BD221 5 12V alarms, make a noise about as loud as a car horn. Slightly soiled but OK.
- BD242 2 6in x 4in speakers, 4 ohm made from Radiomobile so very good quality.
- BD252 1 Panostat, controls output of boiling ring from simmer up to boil.
- BD259 50 Leads with push-on 1/4in tags - a must for hook-ups - mains connections etc.
- BD263 2 Oblong push switches for bell or chimes, these can mains up to 5 amps so could be footswitch if fitted into pattress.
- BD268 1 Mini 1 watt amp for record player. Will also change speed of record player motor.
- BD283 3 Mild steel boxes approx 3in x 3in x 1in deep - standard electrical.
- BD293 50 Mixed silicon diodes.
- BD305 1 Tubular dynamic mic with optional table rest.
- BD400 4 Books, useful for beginners, describes amplifiers, equipment and kit sets.
- BD653 2 Miniature driver transformers. Ref LT44, 20k to 1k centre tapped.
- BD548 2 3.5V relays each with 2 pairs changeover contacts.
- BD667 2 4.7uF non-polarised block capacitors, PCB mounting.

There are over 1,000 items in our Bakers Dozen List. If you want a complete copy, please request this when ordering.

EQUIPMENT WALL MOUNT It is a multi-adjustable metal bracket that could be used for mounting flood light, loudspeaker, TV camera, even a fan and on almost any sort of wall or ceiling even between wall and ceiling. The main fixing brackets rotate such that an inward or an outward corner can be accommodated. Front panel also tilts upward or downwards to a reasonable angle and can be easily removed separately for wiring. A very useful bracket. Regular price would be around £6 each. Our price only £3. Our ref 3P72. Or 2 for £5. Our ref 5P152.

SUB-MIN TOGGLE SWITCH Body size 8mm x 4mm x 7mm SBDT with chrome dolly fixing nuts. 3 for £1. Order ref BD649.

COPPER CLAD PANEL for making PCB. Size approx 12in long x 8 1/2in wide. Double-sided on fibreglass middle which is quite thick (about 1/16in) so this would support quite heavy components and could even form a chassis to hold a mains transformer, etc. Price £1 each. Our ref BD683.

POWERFUL IONISER

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REAL POWER CAR SPEAKERS Stereo pair output 100W each. 4 ohm impedance and consisting of 6 1/2in woofer, 2in mid-range and tin tweeter. Each set in a compact purpose-built shelf mounting unit. Ideal to work with the amplifier described above. Price per pair £29.95. Order ref 30P7.

STEREO CAR SPEAKERS Not quite so powerful - 70W per channel. 3in woofer, 2in mid-range and tin tweeter. Again, in a super purpose-built shelf mounting unit. Price per pair £27.95. Order ref 28P1.

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ELECTRONIC SPACESHIP Sound and impact controlled, responds to claps and shouts and reverses when it hits anything. Kit with really detailed instructions. Ideal present for budding young electrician. A youngster should be able to assemble but you may have to help with the fitting of the components on the PCB. Complete kit £10. Our ref 10P81.

12in HIGH RESOLUTION MONITOR Black and white screen, beautifully cased for free standing, needs only a 12V 1.5 amp supply. Supplied with connection data for H sync, V sync & Video. Brand new in maker's cartons. Price £22.00. Free delivery. Order ref 25P10.

COMPOSITE VIDEO KIT converts composite video to H sync, V sync & sep video. Price £8.00. Ref 8P.

14in COLOUR MONITOR made by the American Display Tek Company. Uses high resolution tube made by the famous Japanese Toshiba Company. Beautifully made unit intended for console mounting, but top and sides adequately covered by plated metal panels. Full technical spec on its way to us. We have a limited number of these. All brand new still in maker's cartons. Price £89 each plus £6 insured carriage. Order ref 89P/1.

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3 1/2in FLOPPY DRIVES We still have two models in stock - single-sided, 80 tracks by Chinon. This is in the manufacturer's metal case with leads and IDC connectors. Price £40, reference 40P1. Also a double-sided, 80 track, by NEC. This is uncased. Price £59.50, reference 60P2. Both are brand new. Insured delivery £3 on each or both.

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STROBE LIGHTS Fit a standard Edison screw light fitting. 240V 40min flash rate, available in yellow, blue, green and red. Complete with socket. Price £10 each. Ref 10P80 (state colour required).

ELECTRONIC SPEED CONTROL KIT Suitable for controlling our powerful 12V motors. Price £17.00. Ref 17P3 (heatsink required).

EXTENSION CABLE WITH A DIFFERENCE It is flat on one side, making it easy to fix and look tidy. 4 core, suitable for alarms, etc. Price only £5.00 for 50m reel. Ref 5P153.

METAL PROTECT BOX Ideal for battery charger, power supply etc. Sprayed grey. Size 8in x 4in x 4 1/2in. Louvred for ventilation. Price £3.00. Ref 3P75.